



FIRST LOOKS

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Notebook PC Yet?**



CONNECTIVITY

**PC LAN Labs Tests
Five Direct Token-
Ring-to-Mainframe
Attachments**

FREE UTILITY

**BATCHMAN Adds
Color, Music,
And Power to Your
Batch Files**

VOLUME 9 NUMBER 2

THE INDEPENDENT GUIDE TO IBM-STANDARD PERSONAL COMPUTING

JANUARY 30, 1990

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ten years.

Market Survey and Ten-Year Growth Plan

EXECUTIVE SUMMARY

BLUE YONDER AIRWAYS



Introduction

As Blue Yonder Airways moves from freight to passenger service, the Sales and Marketing Division is presented with a multitude of new challenges and opportunities. This report consists of a marketing proposal for the next ten years -- a virtual blueprint for growth in our critical first decade as a passenger carrier. Our

resulting from a series of focus groups conducted by the market research firm Crump & Graham. The growth plan includes specific suggestions for ways to leverage our track record in the freight arena to win out our share of single-passenger flights, and ultimately expand into cargo sales. A detailed analysis of costs and

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monitors. Pricing based on U.S. Dollars. Prices subject to change without
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TheALR PowerFlexSX*.

"ALR has executed
a masterstroke that could
influence the way all
computers are built."

PC Resource December 1989

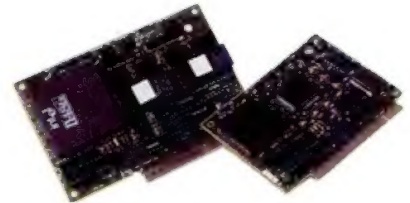
With today's leap-frogging technology, it takes more than just a faster PC to make the competition so upset. You have to deliver something they can't. The 286-based PowerFlex easily upgrades to 386SX™ or i486™ processing. And whatever future processing holds, the PowerFlex's innovative bus design holds your key to tomorrow. That's why the PowerFlex has received so much attention from today's premier computing publications. Byte Magazine wrote, "The PowerFlex offers the widest upgrade path that's currently available." The ALR PowerFlex was built with your future in mind. As technology and your processing needs grow, the PowerFlex can grow with you.

Still, the PowerFlex delivers much more. For a base price of only \$1495 you'll get a 12.5-MHz 286-based PC and 1-MB of RAM with built-in EMS 4.0

support, one 3.5" 1.44-MB floppy drive, a 40-MB hard disk and 101-key enhanced keyboard. Add only \$395 and you've upgraded to 16-MHz 386SX power and speed. The PowerFlex 386SX Module allows you to increase processing speeds by more than 25% and more importantly, gain immediate compatibility with all 386-based 32-bit software. We're even making i486 technology easily accessible. The PowerFlex i486 Module increases processing speeds by more than 510%. And for only \$2995, the cost of ALR's i486 upgrade solution, you'll have "One of the least expensive 80486s on the market".
Byte November 1989

"The PowerFlex
is the most
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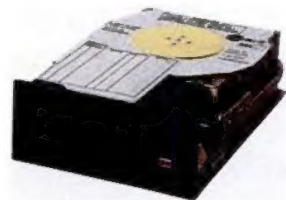
BYTE November 1989



Now until December 31, 1989, save \$50 with ALR's manufacturer's rebate with the purchase of the 386SX Module.

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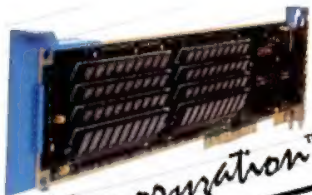
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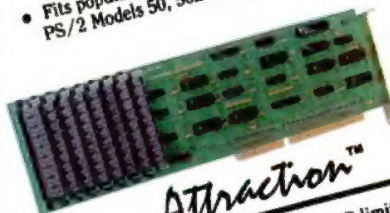
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CIRCLE 177 ON READER SERVICE CARD

Inside

Wouldn't it be great to have your own personal PC guru, someone standing by your side, ready to answer all your questions about DOS esoterica, DIP-switch settings, strange error messages, convoluted software installations, and unfathomable hardware setups?

If you're a regular reader of *PC Magazine's* Productivity section, you already know contributing editor Jeff Prosis. If you don't, flip to the back of the magazine, leaf through the Productivity section, and meet him at the Tutor column, which he began editing last issue.

As the creator of some of *PC Magazine's* most popular utilities—including the printer-enhancing SETUP, the CARD-FILE pop-up Rolodex, and the DOSKEY command-line editor—Prosis is

a natural choice to help you with your questions about both hardware and software. It would be hard to find someone more eager to learn everything he can about PCs and to share his knowledge with equally enthusiastic readers.

An interest in computer graphics led Prosis to his first computer, a Commodore 64 that he bought in 1983, "when the price fell below \$200," he notes. Intrigued by programming but frustrated by BASIC's inadequate graphics, he did what anyone would do under the circumstances: he studied 6502 assembly language until he was capable of writing his own enhanced BASIC pro-



gram with built-in graphics support.

From there it was on to more assembly language and all sorts of language compilers. His addiction, controllable at first, started taking up six hours a night as his wife studied for her college degree. "I didn't feel right about going out with the boys while she worked so hard," he says, "so what else was I going to do?"

Now is a good time to be taking over the Tutor column, Prosis says. "Though

I've written thousands of lines of code for DOS, I started out as a rank beginner just like everyone else when it came to OS/2. I've got a lot to learn about Presentation Manager programming, and I'm looking forward to redoing some of my DOS utilities, including CARDFILE and SETUP, for the



Computing is for the birds, according to contributing editor Jeff Prosis and his Yellow-Nape Amazon parrot, Hawkeye.

new operating environment."

Prosis, who fills the working hours of his day as a mechanical design engineer for a large defense contractor, steps away from his PC just long enough to indulge his fascination for exotic birds. Hawkeye, a Yellow-Nape Amazon parrot whose rendition of "I Left My Heart in San Francisco" is reportedly better than Tony Bennett's, is his late-night computing companion. "I'll bet I'm the only *PC Magazine* contributing editor who spends a significant amount of time vacuuming feathers out of his keyboard," says Prosis. He's probably right.

—Donald P. Willmott

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Experts rate QMS PostScript printers tops in every class

QMS PS-810

Although very similar to the LaserWriter IINTX, the QMS PS-810 is less expensive (\$2,004 less). The PS-810 provides comparable print quality and a parallel port, but its performance is not quite as fast as the IINTX's and it cannot be equipped with a hard disk. The PS-810's 2-megabyte base memory can be expanded to 3 megabytes, which accommodates enough fonts for most users. It can be equipped with the same 1000-sheet cut sheet feeder that fits on the QMS PS-1500, and it comes with the PS Executive Series printer utility as well. The PS-810 was the recommended printer in NSTL's last PostScript printer evaluation, and it may be an even better buy this year in view of QMS's recent price reduction.

- PC Digest Ratings Report
Vol.3, No. 4

standards. The card was a warranty.

If you have a LaserJet Series II and need PostScript compatibility, JetScript offers a ready solution. In fact, the smooth operation and impressive speed of this controller almost justify purchasing the LaserJet just to put the JetScript card in it.

Laser Connection/QMS PS-810. It has a reputation.

Steve Apike
& Stan Diehl
BYTE - 9/88

PC Magazine -
April 25, 1989

complaint.

If you're looking for a laser printer with a PostScript language controller (and the famous 35 Adobe fonts built into ROM), take a look at QMS's superb PS-810. A fast, updated LaserWriter Plus clone, the PS-810 uses the later, superior Canon SX engine and adds that missing parallel connection—plus emulations that range from HP LaserJet Plus to Diablo 630 to HPGL. I use a PS-810 on a second PC in my office and greatly admire this tough, smart machine. Under the hood, the secret is a fair

standard. In fact, the QMS should be ready to connect to just about any type of computer.

For high-volume desktop publishing, network situations, and other intensive PostScript applications where throughput, duty cycle, and paper capacity are issues, the QMS PS-820 is an extremely solid contender. When you add up the pros and cons and compare the PS-820 to other PostScript options, this printer looks very good indeed.

—Jon Pepper

—Jon Pepper
Personal
Computing

Congratulations. We are pleased to inform you that Macworld readers have voted QMS ColorScript 100 the 1989 World Class winner in the Color Printer category. Trophies will be awarded at our third annual World Class Awards Banquet at the Ritz-Carlton during the Macworld Expo Boston. We would like to thank you for your support.

—MacWorld

QMS PS-1500

The QMS PS-1500 combines exceptionally fast performance and high-volume paper capacity. Features include a comprehensive control panel, 4 megabytes of base memory, and 35 internal font outlines. The PS-1500's unique PS Executive Series utility lets users print an advanced status page, download an error handler, and print screens. The PS-1500 can be equipped with a 1000-sheet cut sheet feeder and an external hard disk. The PS-1500's list price of \$7,995 makes it more economical for users with high-volume printing needs.

PC Digest
Ratings Report -
Vol.3, No. 4

QMS offers more Adobe® PostScript® printing solutions in more ways than any other company. And the products we offer continually receive high ratings from industry experts.

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to users who need maximum performance and productivity. Which is why experts say QMS® PostScript products continue to set the pace for the rest of the industry.

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Product	Print Speed	Max. Paper Size
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QMS-PS 810 Turbo	8 ppm	8.5" x 14"
QMS-PS 820 Turbo	8 ppm	8.5" x 14"
QMS-PS 1500	15 ppm	8.5" x 14"
QMS-PS 2200	22 ppm	11" x 17"
QMS ColorScript™ 100 Model 10	1 ppm	8.5" x 14"
QMS ColorScript 100 Model 30	1 ppm	11" x 17"
PS Jet™ (controller)	NA	NA
JetScript™ (controller)	NA	NA



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COVER STORY

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386SX: The New Corporate Standard

John Dickinson/ With prices of 386SX-based machines converging on those of AT compatibles, the case for considering these machines the business world's new entry-level price/performance leaders grows more compelling.



In our largest computer review to date, PC Labs tests 31 brand new SX-based machines and turns up some definite performance winners. Also, our improved features table for PCs helps you detect several intriguing bargains—including full VGA systems priced below \$2,300—that can run all 386-specific software applications.

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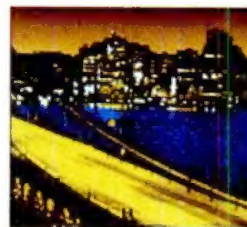
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Bill Howard



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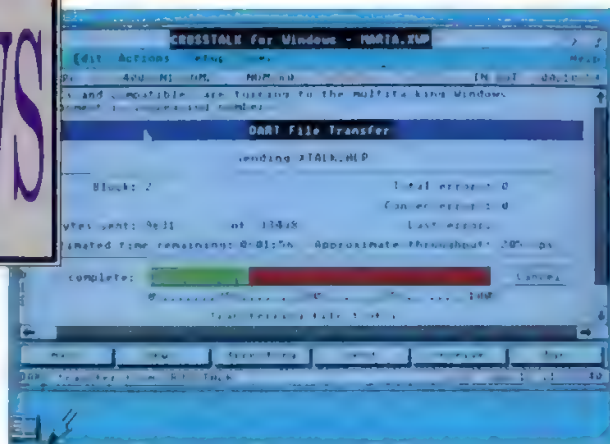
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Letters

PERFECT TIMING

Thanks for your latest printer blockbuster (*PC Magazine*, November 14, 1989). I was just about to write a check for an expensive color dot matrix printer when your magazine arrived. I immediately checked out how the model I had chosen fared in your testing process and was shocked to see that the colors were marred with black splotches and lines. In fact, I was surprised by the terrible black streaks and smudges displayed by many of the high-end printers.

Because of your reviews, I'm now ordering a color printer (with clearer colors) at about half the price. Thanks again for saving me, and my bank account, from a costly disappointment.

William G. Ogle, Jr.

Middletown, Pennsylvania

COVERING THE BASICS

I eagerly pounced on your recent feature on BASIC ("BASIC, Yes; Feeble, No," *PC Magazine*, October 31, 1989). Burdened for years with an inferiority complex from the sneers of programmers of every other language, I was elated when I read that "BASIC in many ways is now more powerful than even C or Pascal." At last, vindicated! I chortled gleefully as I imagined the C hot shots and Pascal snobs writhing with dismay on the point of that remark, their bloated pretensions and delusions finally deflated to the stark reality of facts.

Ralph Vickers

Portland, Oregon

Congratulations on your exceptional article "BASIC, Yes; Feeble, No." As a programmer, I was reluctant at first to work with BASIC, as most of the major computer magazines and journals had labeled it a children's language. But it is BASIC, and BASIC alone, that has these three superlative qualities: a richness of commands, an extremely flexible structure (GOTO is a blessing in disguise!), and a very logical foundation. Only the human mind has similar

qualities, and thus I believe BASIC is the most suitable computer language available to imitate human reasoning. Sure, BASIC is faulted for being a "spaghetti code," but when you get down to it, isn't the human mind a "hyper-spaghetti code"?

Ion Saliu

Biglerville, Pennsylvania

OK—the lengthy article praising the benefits of BASIC as a programming language did it! I want to register an energetic protest ("BASIC, Yes; Feeble, No").

I have been reading *PC Magazine* from the year the first IBM PC was introduced, when I purchased a machine. In all that time, I cannot recall reading one article about the COBOL programming language. Yet I would wager that the vast majority of programs running throughout the world on a daily basis are written in COBOL. Moreover, with many of these programs resident on mainframes, and with the connection of PCs to mainframes now easily accomplished, COBOL has become even more important to the PC user.

Ben Sabia

Siloam Springs, Arkansas



PRINTERS: and the ink flows on, and on, and on. . .



PC Magazine is the first to admit that COBOL has many fans. However, in the world of personal computing, other languages hold court: BASIC, C, and Pascal are the languages most readers are interested in. Magazine editors always shout that editorial space is a very limited resource—unfortunately this is true. Should we see overwhelming evidence that COBOL is making major inroads into the desktop environment, we will definitely take a look at it.

SMASHING WINDOWS

I must take issue with the statement in John C. Dvorak's column that "aesthetics is more important than performance" in computer software (John C. Dvorak, *PC Magazine*, October 31, 1989). Like Dvorak, I enjoy great graphics when they happen to turn up in a program. But I would trade all the "pretty" in the world for a program that works.

James V. McConnell

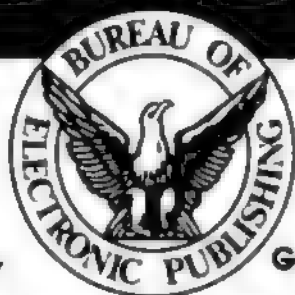
Ann Arbor, Michigan

John C. Dvorak continues to hurl rocks at *Microsoft Windows* (John C. Dvorak, October 31, 1989). And while he gathers his next handful, the *Windows* market zooms right past him.

Dvorak tells us that *Windows* is "so ugly that it offends the senses when it appears on the screen" and that "its colors are weird." Now, I don't know about you, John, but I always thought that was the function of the *Windows* Control Panel: to allow color changes and other customization. But I guess you'd have to use the program for more than 5 minutes before you'd know that, huh? Are we to assume that you find the C: prompt arousing?

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Letters

dows Manager, Click Start, PubTech File Organizer, and The Desktop Set—to get whatever aesthetics you want.

My advice to you, Mr. Dvorak: put down the rocks, lug your Mac portable to the nearest bomb shelter, and quickly duck. The Windows market is exploding, and just maybe you'll be safe. But I doubt it.

Dave Howell
Oregon City, Oregon

The quantity of negative letters printed concerning articles written by John C. Dvorak would bother me if I were the publisher of *PC Magazine*. I truly had one of those

**Advice to Dvorak:
put down the rocks,
lug your Mac portable
to the nearest bomb
shelter, and duck.**

"bone-shaking deep-in-the-body shivers" Dvorak speaks of when the October 31, 1989, issue of *PC Magazine* came in the mail today—literally, because I wondered what trash my subscription money was bringing me in the form of Dvorak this time. I'm perfectly serious; that was my first thought. Then I read his article about *Microsoft Windows*.

First, the man personally belittled a programmer, to whom he owes an apology. Then he implied that artistic temperament cannot be taught. Writing is universally considered to be an art form, and Dvorak has failed in that regard miserably. Third, he emphatically states that "the public doesn't perceive Microsoft as a performance-oriented company." I belong to that public, and I tell you that Microsoft is *nothing but* performance. I use many of the company's products and much of its literature, and I learn more about "IBM-standard computing" from them than I ever will from your ad-laden magazine.

Get a job, Dvorak.
David S. Mohler
Dayton, Ohio

While I don't always agree with John C. Dvorak's views, I do agree with his position that presentation and perception are more important than performance (John C. Dvorak, October 31, 1989). Which leads me to think that he should also apply this reasoning to himself; namely, get a new tie and button the top button of your shirt, John.

Tracy Powell
Orem, Utah

PC UPDATE

In your September 12, 1989, issue, you ran a review of Telemart's MIT Systems 286-12 computer ("286s: No Frills, Few Thrills," *PC Magazine*, September 12, 1989). Your reviewer, Bruce Brown, gave the machine top marks.

The 286-12 was listed as using a 1:1 interleave controller, yet when I called Telemart and asked about that, I was told that a 2:1 controller was used and that a 1:1 controller would not be proper for this system.

I can live with that, but the article also stated that the on-site service plan could be extended "for the incredibly low price of \$25 per year." When I spoke to Telemart, however, I was told that the price for the extension of the contract was \$225, not \$25. That's a big difference, and one that will probably mean a great deal to prospective buyers. Furthermore, service, according to Mr. Brown, is provided by Sorbus, when in fact it is provided by TRW.

I've always read *PC Magazine* with great confidence in the content of the articles, and I'm very disappointed with this terribly misleading review.

Joanne Fennin
Rockville, Maryland



It is true that the cost for one extra year's extended warranty and on-site service for the MIT Systems 286-12 is \$225 and not \$25. *PC Magazine* was provided erroneous information based on a typographical error from one of the vendor's suppliers. Also, Telemart has switched from Sorbus to TRW for on-site service; TRW will service computers in residences as well as business locations, while Sorbus services computers only at business locations.

Changes have also occurred in the system since we initially reviewed it: the standard memory has doubled from 512K to 1MB, the 8-bit VGA card has been upgraded to a 16-bit unit, the standard VGA monitor has been upgraded, and the drive control-

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Floppy Drive	One - 1.2 or 1.44		One - 1.2 or 1.44	
Std. Hard Drive Capacity	20 Mbyte		32 Mbyte RLL	
Hard Drive Type	IDE Built-in		Can use - RLL, MFM, IDE, ESDI	
I/O Capabilities	2 Ser., 1 PP		2 Ser., 1 PP	
Keyboard	"Mushy Touch" 101		Famous OmniKey/102	
Software	Diagnostic		On-Line Help, MS-DOS	
Space Saver Case	15"W. 15"L. 4"H		14.5"W. 16.5"L. 5.5"H	
Moneyback Period	30 Days		30 Days	
Warranty	1 Yr. Parts & Labor		1 Yr. Parts & Labor	
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Letters

ler and hard drive combination has been changed to provide significantly better performance. The price of the VGA-equipped

It seems that *PC Magazine* is looking for a new name. How about *386 Magazine*?

configuration has changed, as well, from \$1,974 to \$1,918.

Readers should keep in mind that *PC Magazine*'s review process by necessity has an inherent time lag between testing and actual publication. In that time, it's not unusual for vendors to change their system configurations, often including more for the money as they attempt to keep their competitive positions.—*Bruce Brown*

UPGRADE BLUES

Hurray for Jim Seymour's article on upgrading to *Lotus 1-2-3*, Release 3.0 (Jim Seymour, *PC Magazine*, October 17, 1989). As a PC coordinator, I fully identified with Mr. Seymour's description of the upgrade scenario. The hassles involved in setting up the new version of *1-2-3* have made me reluctant to recommend it.

I feel that what it really comes down to is this: How badly do most users need all the bells and whistles? In our company, I have only recommended Release 3.0 for our accounting department. Release 2.2, on the other hand, is a good idea. It's probably the best compromise for both the user who has to have the newest products and the manager who knows that all the extras aren't necessary to accomplish the work.

I, for one, don't jump at new releases anymore.

David Knecht

Puyallup, Washington

NAME GAME

The cover of *PC Magazine* proclaims it as "the independent guide to IBM-standard personal computing." Most of your advertisers obviously feel that way; so, I

suspect, do most of your subscribers. As each issue arrives, however, I begin to wonder whether the editorial staff feels the same way.

Bill Machrone was quoted in a recent column in our local paper as saying *PC Magazine* had "moved away from PCs, XT's, and AT's." In the September 12, 1989, issue, meanwhile, "286s: No Frills, Few Thrills" is the haughty title of a review of a sample of products from what I suspect is the largest segment of the PC market (and, no doubt, your own market) both in dollars and quantity.

The view from here is that *PC Magazine* is looking for a new name. How about *386 Magazine*?

William R. Baldwin III

Midlothian, Virginia

CORRECTIONS & AMPLIFICATIONS

Owing to a production error, incorrect printer names and test bars were published in the chart entitled "PC Magazine Printer Guide: Laser Printers" on page 106 of the November 14, 1989, special issue on printers. The guide entries (each of which includes test results, text and graphics samples, prices, and descriptors) correspond to the following printers (from top to bottom): the Epson EPL-6000, the Fortis DP600P, the Fortis DP600S, the Fujitsu RX7100, the Fujitsu RX7100PS, and the Fujitsu RX7200.

Contrary to the features table, *Bit-folio Computer Art & Symbols Library*, from Coddbarrett Associates ("PC-based Clip Art: Instant Images," *PC Magazine*, October 17, 1989), is composed of object-oriented vector files. Selections for slide and pen plotter users are available fully colorized, and images for laser printer users have been optimized by using fill patterns. Furthermore, images, as well as image colors, can be modified by the user.

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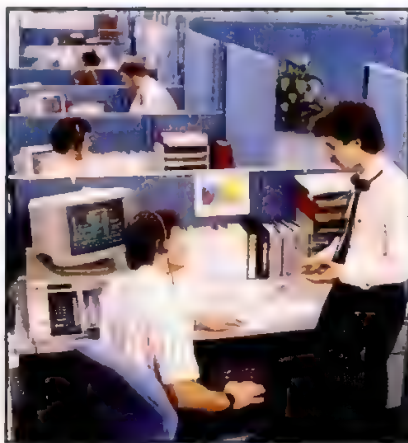
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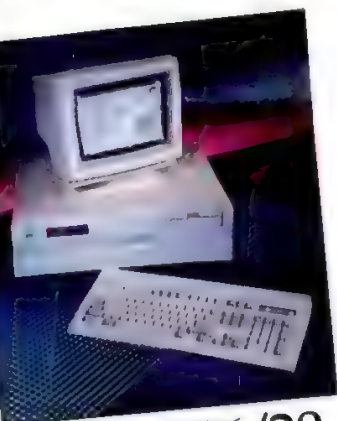
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Standard Features	386/20	386SX	286/12	XT10
CPU	80386	80386SX	80286	8088-1
Speed (MHz)	20.8	16.8	12.5/6.25	10.4
BIOS	Phoenix	Phoenix	Phoenix	Phoenix
Norton SI Rating v.4.0	22.0	17.6	12.4	2.1
Standard Memory	1MB	1MB	512K	640K
Shadow BIOS	Yes	Yes	Yes	Yes
Memory Upgrades	Yes	Yes	Yes	Yes
Coprocessor Support	Yes	Yes	Yes	Yes
Expansion Slots 32-bit	1	6	6	6
Expansion Slots 16-bit	4	2	2	2
Expansion Slots 8-bit	3	2	2	2
Dual HD 1D Controller	Yes	Yes	Yes	Yes
5.25 Floppy Drive	Your Choice	Your Choice	Your Choice	Your Choice
3.5 Floppy Drive	Exp. 2nd	Exp. 1st	Exp. 2nd	Exp. 2nd
Device Bays	2	1	1	1
Serial Ports	1 Parallel	1 Parallel	1 Parallel	1 Parallel
Additional I/O Ports	200W	200W	200W	150W
Power Supply	101 Key	101 Key	101 Key	101 Key
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w/ 12MB Hard Drive & 1 Interface	\$1249 \$1299 \$1599 \$1749



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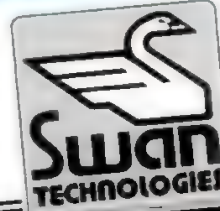
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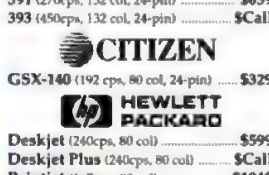
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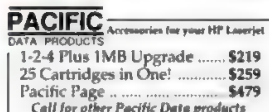
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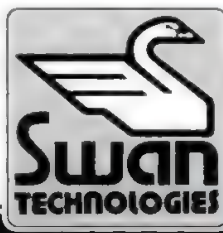
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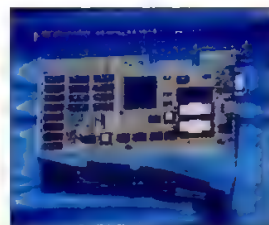
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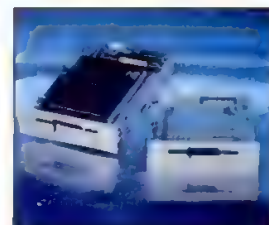


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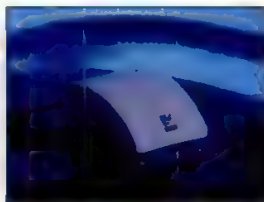
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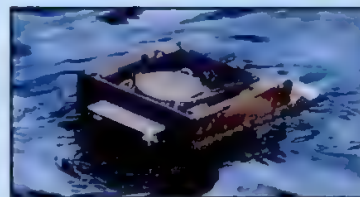


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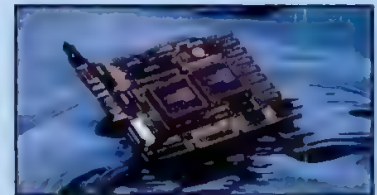
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CIRCLE 174 ON READER SERVICE CARD

by Lori Grunin

Advisor

WANG WP REDUX

Your Advisor column in the October 31, 1989, issue answered a question regarding conversion of Wang word processing documents to DOS-based word processing formats. You recommended a conversion software package.

Having faced the same problem, I instead bought a copy of *PFS:Professional Write*, Version 2.1, for approximately \$125. This program will both read and write the Wang PC format and will also handle several other popular word processing formats with ease.

Jerry W. Manry
Waco, Texas



Sometimes I forget that a little creativity can go a long way. The word processing package *PFS:Professional Write* (\$229; Software Publishing Corp., 1901 Landings Dr., P.O. Box 7210, Mountain View, CA 94039; (415) 962-8910) can certainly do the job, as can any word processor that directly accepts Wang documents and outputs files in several different formats. If you can find such software discounted to a price below that of a conversion package, then that's obviously the most cost-effective solution.

Several other readers took the time to inform me that I left out some alternatives, including *W-Link* and *Archive-Link* (\$300 each; M/H Group, 300 W. Adams, #84, Chicago, IL 60606; (312) 443-1222) and the MCS Group's *Word Doctor Plus* (\$295; 2465 W. Chicago St., Rapid City, SD 57702; (605) 341-6755). We've never reviewed these packages in *PC Magazine*, but they do exist, despite their omission in the October 31, 1989, issue.

MEMORIES

I'm in the process of building a clone and need some things clarified. Why does the system need nine RAM chips, at two banks each? Also, please explain the DRAM chip numbering; for instance, what do "41256-12," "44256," and "256 x 4" mean? Fi-

■ **WANG WP REDUX:**
More Wang word
processing conversion
packages.

■ **MEMORIES:**
Navigating through the
arcane world of computer
memory chips.

nally, a discussion of SIMM and SRAM as they relate to DRAM would be helpful.

Any references that you could suggest on the above topics would also be greatly appreciated.

William Myers
Ofallon, Illinois



First, let's talk about types and packaging of RAM, or *random access memory*. In a nutshell, *static* RAM and *dynamic* RAM are two types of memory chips, and SIMMs—*single in-line memory modules*—are a way of packaging those chips.

Now for the long-winded version.

What's the difference between DRAM and SRAM? DRAM can't retain data for very long and needs to be constantly *refreshed*—reminded that this bit is a zero and that bit is a one. SRAM, on the other hand, can maintain its state as long as a current flows through the chip.

Because it has to be frequently refreshed, DRAM imposes a speed penalty: it's not just waiting for the processor to fetch data—the processor has to wait for the memory's refresh cycle to end before it can access information. No such penalty is incurred with SRAM.

DRAM operates more slowly than SRAM: the fastest DRAM runs at about 60 nanoseconds (billionths of a second), whereas the fastest SRAM zooms down into the single digits. One thing to keep in mind here is that these numbers represent *rated* speeds, a target for a batch of chips. Some chips within the batch can run faster

than their rated speeds; when someone refers to "handpicked" 100-ns. chips, for example, it means that the chips can run faster than 100 ns.

The optimal speed of your memory depends on the speed of your CPU. Let's say your processor has a clock speed of 10 MHz (10 million cycles per second); that means a cycle occurs every 100 ns. If you're using 200-ns. RAM, the CPU has to wait one cycle for every access—what's known as a *wait state*. 100-ns. RAM theoretically yields zero wait states. I say "theoretically" because wait states really depend on many factors, including bus timing, and any fractional wait state less than one is usually called zero. Furthermore, systems operate over a range of wait states, depending on the hardware involved in a given process.

Since SRAMs cost a lot more than DRAMs, they are usually relegated to a small cache that holds the most recently fetched data. For instance, in a 25-MHz (40-ns.-cycle) system with 80-ns. DRAM, a small SRAM cache can help offset the imposed wait state.

Now, on to packaging. RAM comes in several different styles: the aforementioned SIMM, DIP (dual in-line package), SIP (single in-line package), and ZIP (zig-zag in-line package). (Occasionally people will say the *P* stands for *pin* in all of the above; this is an accepted variant.) DIPs are the most common and the ones that you probably see when you look at your system board; they're usually neatly laid out in rectangular formations, plugged into sockets or soldered down onto the board.

SIMMs are gaining on DIPs in popularity. They are circuit cards with several RAM chips soldered onto them; the card's edge connector plugs into a special SIMM slot on the motherboard or memory card.

Lesser-known and -seen SIPs have pins out of only one side (DIPs have them on both sides), and come in individual packages or on edge-connecting boards. ZIPs are so rare that few people around here have seen them, but they're reported to

Advisor

have two staggered, rather than symmetrical, rows of pins.

You're probably wondering which is the more desirable arrangement, SIMMs or DIPs. It depends. SIMMs are easier to replace than DIPs. On the other hand, if one DIP chip goes bad, you don't have to replace the whole bank; if a chip on a SIMM fails, you have to buy a whole new SIMM.

It's also easier to figure SIMMs out because each SIMM generally has 256K or 1MB on it. With DIPs, you have to buy a certain number of 256 kilobit or 1 megabit chips.

Now let's go back to your first question. The ninth chip in each bank is called a *parity* chip; parity checking is a common error-detection method used in binary systems. In a PC, all the ones and zeros in a byte are summed. If the total is even, that byte is assigned a one; if odd, it's assigned a zero. Then it adds that one or zero to the total and stores the result, which is always even. (That's why the PC

is called an *even parity* system.) If the number comes out odd, for instance, you get a parity error reading.

If you look at advertisements for memory chips, you'll notice that they are sold in groups of eight as well as nine. That's because, for example, some Apple machines use nonparity chips and therefore take them in banks of eight.

Finally, your second query: how to dissect the cryptic codes that identify RAM chips. First, a "256 x 4" DIP means it's a 1Mb chip (256 times 4 = 1,024); if it were 256 x 1, then it would be a 256Kb chip. A bank of 9 256 x 1 chips (or a 256 x 1 x 9 SIMM) is 256K, while a bank of 9 1Mb chips (or a 256 x 4 x 9 SIMM) is 1MB.

The ID code of a chip is the top line of alphanumeric characters that you see when you look at the chip. Usually, the code is prefaced by one or two characters that refer to the manufacturer. Then come numbers such as 41256-12. The four digits to the left of the hyphen tell you that it's a 256 x 1 chip. The "-12" tells you how fast the chip is—in this case, 120 ns. Sometimes the codes aren't quite as clear, but you can usually tell how large and how fast a chip is. For instance, KM41C1000AP-

8 is a more complex example, but you can see that it's an 80-ns., 1Mb chip.

If you want more information about chip IDs, the *1989 IC Master* (published annually; \$140 prepaid, \$150 billed; Hearst Business Communications, 645 Stewart Ave., Garden City, NY 11530; (516) 227-1300) is an invaluable three-volume reference work that tells you everything you've ever wanted to know and more about the chips currently on the market. Although the price is a bit stiff for the individual user or hobbyist, it's worth seeking out in a local library; anyone who frequently buys chips via mail order can't afford to be without it.

A longer dissertation about SRAM, DRAM, and parity appears in the Lab Notes article "Instant Speedup for Your PC," in the July 1988 issue of *PC Magazine*.

ASK THE ADVISOR

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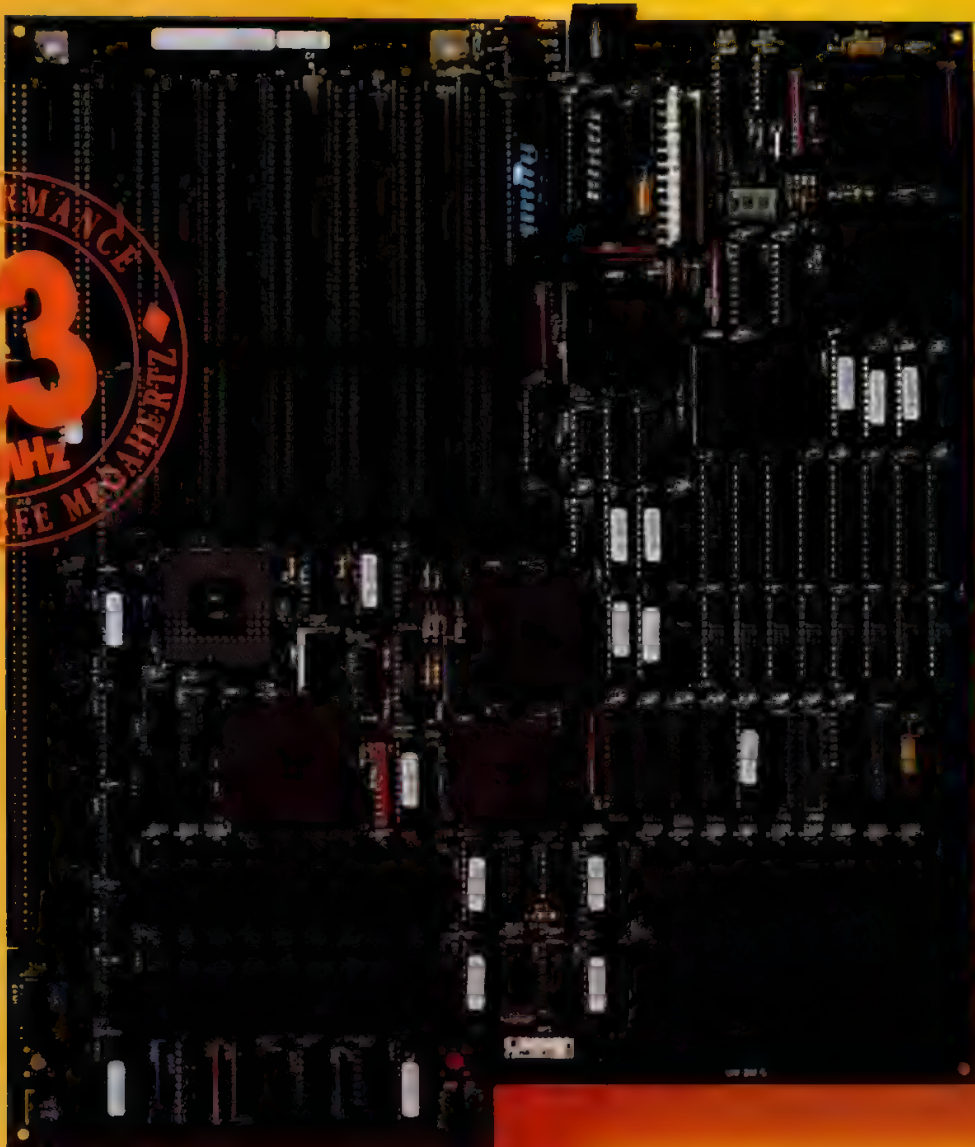
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CIRCLE 276 ON READER SERVICE CARD

First Looks

Hands-on Reviews of the Latest Products

Toshiba T1000SE Distinguished By Excellent Backlit Display, Comfortable Keyboard

HANDS ON
by Lori Grunin

In Japan, Toshiba calls it the DynaBook—a wholly appropriate name for the 6-pound, slightly-bigger-than-a-notebook computer that you want to keep at your fingertips.

But in the U.S., the \$1,699 machine is called the T1000SE—a name that will inevitably invite comparison with the company's bargain-basement T1000. Besides the name and the fact that they make up the low end of Toshiba's line of portable computers, the two share little in common.

The T1000SE's beautiful backlit LCD screen most clearly differentiates it from the non-backlit, scrunched-screen T1000. At 7.5 by 4.75 inches, the T1000SE's double-scan CGA screen is the tallest in the notebook category, allowing it to use larger character boxes and Toshiba's unique, elongated text font. (You can also switch to a more fragile-looking font via a hotkey.)

Although the Compaq LTE series and the NEC UltraLite have very good displays, their text is marginally less readable and the graphics slightly more distorted, and the Compaq has slightly more ghosting than the Toshiba. The T1000SE's screen easily outshines the Zenith MinisPort's anemic offering.

How long does the nickel cadmium battery power this great display? Unfortunately, not long enough. The PC Labs battery-life test rates it at about 2 hours, with 4 hours to re-

With modem, 2MB RAM card, and transformer, the Toshiba T1000SE weighs just under 7 pounds.

charge (albeit with the power-hungry 2MB RAM card). You can charge the battery while the machine is running, but it takes about half a day. The machine has three main battery-saving options: a timed display shut-down, automatic modem power-off, and a hotkey that downshifts the 9.54-MHz 80C86 processor to 4.77 MHz.

Unlike the T1000's, the T1000SE's battery pack is removable, using an ingenious design that lets you slide it right off the back of the computer. Since the compact battery weighs just under 11 ounces, carrying an extra is an annoying

but not very heavy burden. The whole unit (with modem and battery) plus the tiny 10.4-ounce power brick weighs in at just under 7 pounds.

The standard storage in that 7 pounds consists of 1MB RAM and a 1.44MB floppy disk drive. 384K can be configured as a battery-backed RAMdisk (called HardRAM) or as LIM 4.0 memory. DOS 3.3 comes in ROM.

You can buy a 1MB (\$699) or 2MB (\$1,199) RAM card to plug into the memory expansion slot. As long as there's life in

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REVIEW INDEX

HP PostScript Printer Cartridge

Adds fast PostScript to the HP LaserJet Series IID 36

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Rescue Plus

Damage control for 1-2-3, Symphony 51

the battery and you don't remove the card from the machine, you won't lose your programs. The 2MB card was just enough to hold my vital applications—a small word processor and a few communications packages.

In addition to the memory expansion slot, the T1000SE has a 100-pin expansion bus connector, a proprietary modem slot, a 9-pin serial port, and a

CONTINUES ON PAGE 35

Modernized User Interface Gives Mac-like Functionality to FoxPro

HANDS ON
by Salvatore P. Ricciardi

With an event-driven user interface and an assortment of new features, Fox Software's *FoxPro* is not just a mere update of its successful predecessor, *FoxBASE Plus*. Rather, the recently released \$795 database manage-

ment system represents a major effort to bring Macintosh-like functionality to the character-based DOS environment.

The first thing you'll notice about the new program is its user interface. Patterned after Fox's Macintosh product, *FoxBASE Plus/Mac*, it features complete mouse support,

multiple windows, pull-down menus, dialog boxes, and scroll bars—all in a speedy character-mode environment. The interface is quite easy to use, representing a major improvement over other user interfaces in this product category.

You can perform almost any

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PHOTOGRAPH: THOM O'CONNOR

First Looks

FoxPro

CONTINUED FROM PAGE 33

operation with a mouse—and indeed you should. The program is so well tuned for mouse use that you should give it a try even if you're a die-hard mouse hater. Dedicated touch-typists need not fear, however, since the program fully supports keyboard use.

FoxPro's enhanced browse command supports a number of impressive features, including the ability to validate data entered while in browse mode using, among other things, user-defined functions. You can split browse windows into two linked panels, one of which can display data in record-oriented Edit fashion while the other uses the traditional spreadsheet-like browse display. When used in this manner, the panels can be linked, in which case the records will move in sequence in both panels. Up to 25 browse windows can be opened simultaneously.

FoxPro's object-oriented report writer has a page-preview feature, so you can see what your report will look like when printed. When designing a report, you can easily click and drag objects around on the report's surface, which encourages experimentation. You can include calculated fields, totaled fields, built-in functions, and even user-defined functions in a report definition.

You can call up and edit report formats or use them as the basis for a new report. Unfortunately, *FoxPro* does not include an option to generate source code to produce the report, which would let you modify formats when canned reports won't do the job.

Several features useful for debugging programs are included. For example, you can open a trace window to monitor program execution line by line; each line is highlighted as it executes. And you can set an unlimited number of break points by clicking on source lines visible in the trace window.

FoxPro also offers a single-step mode, in which your pro-

gram executes one line per mouse click in the trace window. A separate debug window is available, in which variables and expressions can be monitored in real time as a program executes. In addition, you can set break points to occur when an expression in the debug window changes value.

A built-in text editor includes such features as automatic indentation, clipboard cut-and-paste, find-and-replace, undo, and optional word wrap. It can handle files as large as available disk space will allow. The editor commands are configurable through *FoxPro's* keyboard macro system, so you can make the editor behave like your favorite—although it probably won't perform as quickly.

In addition, *FoxPro's* enhanced memo fields can hold any type of data, so binary data such as scanned images, graphics images, and even executable files can be stored in a memo field. A memo field can now be as large as available disk space. And memo fields are treated much more like strings, so string functions such as \$ and

AT() can be used on memo fields of arbitrary length.

One of the most important things *FoxPro* does is to give programmers the ability to develop event-driven applications. Using the built-in support for windows, the mouse, and recognition of mouse and keyboard events employing On Event-type code, you can build a completely modern multiple-window application with pull-down menus.

FoxPro makes use of the same Define Window syntax as *dBASE IV*, but it extends the syntax in useful ways in terms of mouse support. For example, the Float/NoFloat option defines whether a window can be moved on-screen. Similarly, the Grow/NoGrow option specifies whether the size of a window can be interactively changed. Other options include Zoom/NoZoom and Close/NoClose.

FoxPro is fully compatible with *FoxBASE Plus* and *dBASE III Plus* and language-compatible with *dBASE IV*, although some of *dBASE IV's* features are not supported. For example, *FoxPro* does not support *dBASE IV's* .MDX files. Nor does it handle Set Skip To, Lookup(), and Rollback commands; SQL (Structured Query Language); QBE (Query-By-Example); or transactions.

Although *FoxPro* is certainly feature-rich, it isn't perfect. The program's help system needs hotlinks to its "see also" references, and when the help window is zoomed to full-

CONTINUES ON PAGE 35

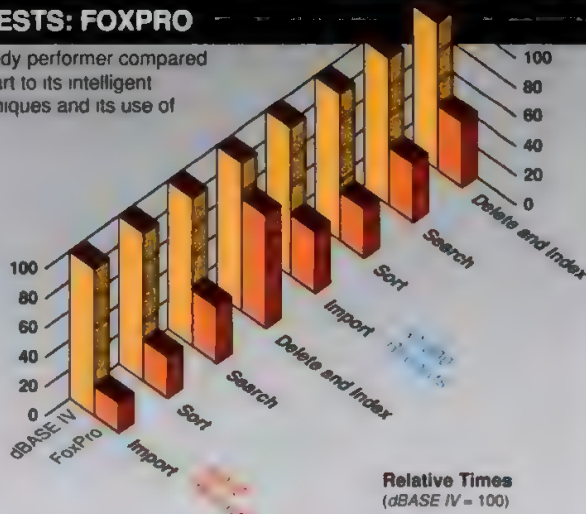
PERFORMANCE TESTS: FOXPRO

FoxPro proved to be a speedy performer compared with *dBASE IV*, thanks in part to its intelligent memory-management techniques and its use of expanded memory.

The **Import** test measures how quickly the database can import an ASCII file (of either fixed field length or comma-delimited format) with an index on the first field. We include the indexing portion of the test to avoid penalizing programs that automatically index the first field during the data conversion. Some programs require a two-step process for this test: an import followed by indexing.

The **Sort** test measures the time it takes for the package to sort the files on an unindexed field in ascending order.

The **Search** test measures the time it takes to locate the first record that satisfies two criteria (make = Fendhi and model = coupe).



The **Delete and Index** (four-column version) test measures the time required to remove four columns (Units, SellPrice, BuyPrice, and

TranDate) from a Product table created for this task, and then to reindex the file if necessary.

Performance Times

(Times given in seconds)

	Import	Sort	Search	Delete and Index	Import	Sort	Search	Delete and Index
dBASE IV	298.00	92.00	13.00	38.00	1,637.00	1,822.00	10.00	619.00
FoxPro	62.00	26.00	5.00	29.00	678.00	606.00	4.00	273.00

50,000 Records

FACT FILE

FoxPro

Fox Software Inc., 134 W. South Boundary, Perrysburg, OH 43551; (419) 874-0162.

List Price: \$795.

Requires: 512K RAM, DOS 2.0 or later.

In Short: A first-rate database DBMS with a modern user interface. Fully supports the mouse and provides facilities that allow you to build this support into customized applications. Needs better documentation.

CIRCLE 448 ON READER SERVICE CARD

First Looks

Toshiba T1000SE

CONTINUED FROM PAGE 33

combined parallel/external floppy disk drive port. Toshiba won't be offering an expansion chassis itself but will rely instead on third-party suppliers, as it does for many of its other laptops. The machine accepts the same modems as the T1200 and T1600 series of computers.

The keyboard, of course, is another vital concern—no one enjoys having to look down every other second because the keys are in the wrong places. The T1000SE's 82-key keyboard suffers from no such problem; it's as well laid out as

it could possibly be, using a configuration similar to that of the T1000's keyboard. Nor did Toshiba compromise the feel of its keyboard by flattening it, as Compaq and NEC did with theirs. The keys are sculpted and well spaced, with a firm touch.

The T1000SE includes the AutoResume feature found in some of Toshiba's other battery-operated portables, a capability that every laptop should have. AutoResume takes a snapshot of your system when you turn off the power; when you power-up again, it puts you right back where you were, without rebooting.

Aside from its battery life, the machine has few serious flaws. It has no handle, which

makes throwing it into a bag a bit cumbersome. On our review unit, the Ctrl key tended to stick annoyingly, and the floppy disk drive made a ticking sound that might raise the eyebrows of an airport customs official.

Although the T1000SE is a great machine, it's not for everyone. If you can't live without a hard disk, need to run heavy-duty applications, or want a battery that's going to endure an overseas flight, look elsewhere.

But for on-the-road word processing and communications, the T1000SE has little competition. The T1000 is much less expensive, but its display is difficult to read. A similarly configured Compaq LTE has a longer battery life, a heavier package, and a much

higher price tag. The NEC UltraLite is 2 pounds lighter but lacks a floppy disk drive and costs more. At a probable street price of about \$1,300, the T1000SE isn't a machine to be taken lightly. ■



FACT FILE

Toshiba T1000SE

Toshiba America Inc., 9740 Irvine Blvd., Irvine, CA 92718; (714) 583-3000.

List Price: \$1,699.

In Short: An eminently usable notebook computer with an excellent display and keyboard. Its only drawback is a disappointing 2-hour battery life when fully loaded.

CIRCLE 436 ON READER SERVICE CARD

FoxPro

CONTINUED FROM PAGE 34

screen size, its performance is very slow. In addition, FoxPro's color system is difficult to master, even for experienced dBASE programmers.

But perhaps the biggest disappointment is FoxPro's lack of a true .EXE compiler: you'll still need to use a runtime version to distribute customized applications. (At press time, a runtime module was not available, although Fox Software is planning to release one for \$500. A \$1,095 network version, FoxPro/LAN, is also planned.)

FoxPro's weighty documentation also needs work. Since so many features have changed during development, the manuals are out of date. A "Release Notes" guide tries to make up for this, but attempting to find the information you're looking for is a frustrating process.

These complaints aside, FoxPro sets a new standard for others to follow in the PC database management arena. Its easy-to-use interface, combined with the many features it provides programmers for developing modern applications, makes FoxPro a first-rate product. And Fox Software's reputation for listening and responding to its customers' criticisms almost ensures that the next version of FoxPro will be even better. ■

BENCHMARK TESTS: TOSHIBA T1000SE



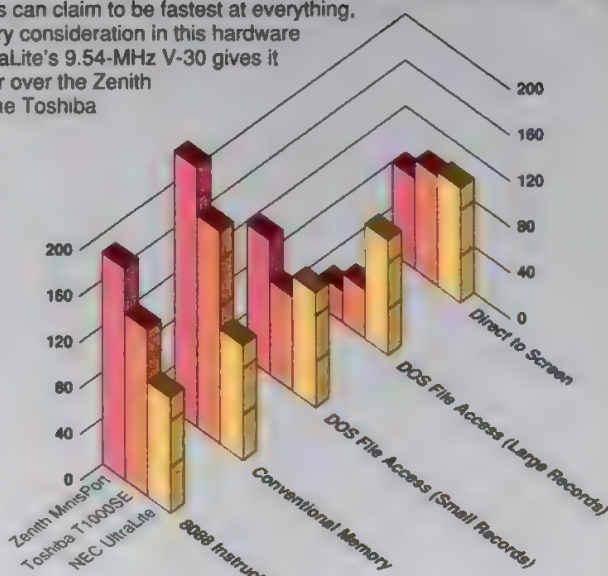
None of these machines can claim to be fastest at everything, but speed is a secondary consideration in this hardware category. The NEC UltraLite's 9.54-MHz V-30 gives it an edge in raw computing power over the Zenith MinisPort's 8-MHz 80C88 and the Toshiba T1000SE's 9.54-MHz 80C86.

The **8088 Instruction Mix** benchmark test times a series of tasks specific to the 8088 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.

The **Conventional Memory** benchmark test measures the read/write speed of the first 640K of memory. Slower relative times can indicate the presence of memory wait states or memory chips rated at slower access speeds.

The **DOS File Access (Small Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data.

The **DOS File Access (Large Records)** benchmark test times



disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk-subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are loaded.

The **Direct to Screen** benchmark test indicates the speed of the video adapter memory. Good scores indicate that information can get to the screen quickly, particularly for programs that avoid the computer's BIOS and go directly to the screen.

Performance Times (Times given in seconds)	8088 Instruction Mix	Conventional Memory	DOS File Access (Small Records)	DOS File Access (Large Records)	Direct to Screen
Zenith MinisPort	18.73	3.63	51.73	7.74	5.22
Toshiba T1000SE	14.77	2.96	36.14	12.15	6.26
NEC UltraLite	10.16	1.60	44.00	28.63	6.53

First Looks

HP Printer Cartridge Brings PostScript to The LaserJet Series IID—Fast

HANDS ON
by Edward Markey

Hewlett-Packard has released its \$995 PostScript Printer Cartridge for the LaserJet Series IID, only a few weeks after Pacific Data Products released its \$695 PacificPage PostScript cartridge for the LaserJet II. Using the HD's Canon engine, the HP cartridge produces some of the deepest blacks and subtlest shadings ever seen from a 300-dot-per-inch PostScript device, and it produces them at a speed almost equal to that of the IID's normal mode.

In the LaserJet IID, HP's cartridge prints text about twice as fast as the PDP cartridge in the Series II, and graphics about five times faster. The variation in speed between the PDP cartridge for the Series II and the HP cartridge for the IID results from differences between the controllers in the two printers.

Both the PDP and HP cartridges require 2MB additional memory in the printer, which gives them room for at least four soft fonts in addition to the 35 built-in fonts. With 4MB of additional memory in the printer, both cartridges can use the extra RAM for additional fonts.

HP licenses its PostScript interpreter and fonts from Adobe,

PostScript's originator. One advantage is that you can use Adobe soft fonts, which match the fonts in Linotronic typesetters. One disadvantage is that the 35 built-in fonts are the earliest and least-successful fonts ever issued by Adobe. The corresponding Bitstream fonts in the PDP cartridge, which uses the PhoenixPage PostScript interpreter, are better designed in every way. The PDP cartridge also does a better job of creating smooth and lively looking type at 300 dpi.

HP's cartridge lacks some of the flexibility of the PDP. The PDP lets you switch from PostScript to HP mode, either from the printer's control panel or by sending software commands. HP makes you turn off the printer and remove the cartridge whenever you want to return to HP mode.

When you plug the PDP cartridge into a LaserJet II, you simply select the PostScript driver for your application and print. But the HP cartridge has a hidden "gotcha" that the otherwise detailed manual doesn't bother to warn you about it unless you read very carefully between the lines.

HP trips you up because the part of the printer's ROM that governs the PostScript cartridge is different from the part that controls normal HP mode. With the PostScript cartridge plugged in, you will need to reconfigure the IID as a parallel printer, because the PostScript part of the printer's EPROM still thinks you're using the serial connection.

Until PC Labs made some slight changes in the way we downloaded the benchmark test files to the printer, the HP car-



Once you've torn down the laws in the country yourself face to face with the Devil, what will you

HP PostScript cartridge produces subtle shades.

tridge produced time-out errors that prevented it from completing all the tests. However, we never encountered similar errors with normal applications. HP's technical support is both responsive and responsible, so there's no reason to hesitate over buying the PostScript Printer Cartridge if you want fast, authentic PostScript on the LaserJet IID.

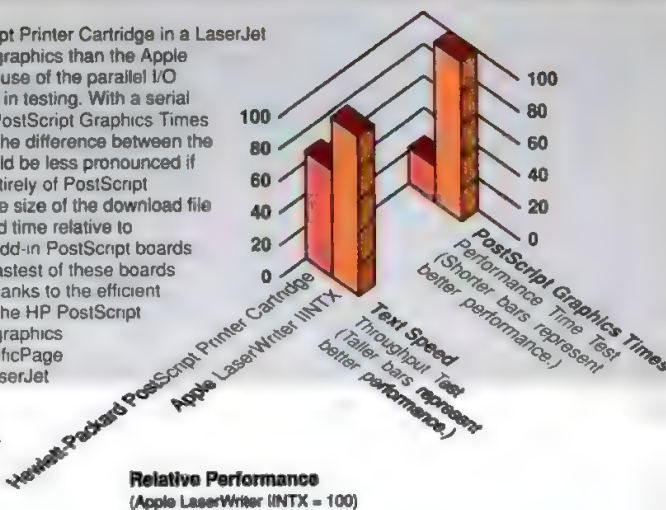


BENCHMARK TESTS: HEWLETT-PACKARD POSTSCRIPT PRINTER CARTRIDGE

The Hewlett-Packard PostScript Printer Cartridge in a LaserJet Series IID is notably faster at graphics than the Apple LaserWriter IINTX, partly because of the parallel I/O connection that PC Labs used in testing. With a serial connection, the result on the PostScript Graphics Times test jumped to 844 seconds. The difference between the parallel and serial timings would be less pronounced if the graphic used consisted entirely of PostScript vectors; a bitmap increases the size of the download file and the proportion of download time relative to processing time. The fastest add-in PostScript boards are faster still—although the fastest of these boards produce lower-quality type. Thanks to the efficient controller in the LaserJet IID, the HP PostScript cartridge prints both text and graphics noticeably faster than the PacificPage PostScript cartridge for the LaserJet Series II.

The Text Speed test prints a two-page single-spaced business letter ten times. Print speed is measured in pages per minute.

The PostScript Graphics Times test clocks the processing speed of PostScript printers. It consists of a bitmap image, some shading patterns, and a group of filled-in curves.



FACT FILE

Hewlett-Packard PostScript Printer Cartridge
Hewlett-Packard Co., P.O. Box 10301, Palo Alto, CA 94303-0890; (800) 752-0900.
List Price: \$995.
Requires: Hewlett-Packard LaserJet Series IID (not Series II or IIP), 2MB or 4MB additional RAM in printer.
In Short: The Hewlett-Packard PostScript Printer Cartridge brings fast, original PostScript to the LaserJet Series IID.

CIRCLE 446 ON READER SERVICE CARD

Tap the Full Power of WordPerfect on your LaserJet.

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RAVE REVIEWS FOR GLYPHIX ■ "... unlike anything else on the market- except possibly PostScript... produces remarkably fine type at amazing speeds." PC Magazine, June 13, 1989 ■ "... offers a combination of features and performance that is unavailable elsewhere. Like PostScript, Glyphix generates fonts from outlines, on the fly, and sends them to the printer as they are needed. The Glyphix system's installation procedure is a snap: just put the appropriate floppy disk in drive a: and type INSTALL. You're asked a few questions about printer port and directories, and then everything happens automatically." Computer Buyers Guide and Handbook ■

AND USERS AGREE ■ "Your approach to font generation is the right one--better than Bitstream, MoreFonts, Trionum, you name it." Christopher Sarson, Blue Penguin Productions, Inc. ■ "I've now been using GLYPHIX 3.0 with WordPerfect 5.0 ... I couldn't be happier with the quality, ease of use, and, most of all, printed output of this product." Claude Carle, Beverly, Massachusetts. ■ "I am using WordPerfect 5.0 and was using Bitstream Fonts. I carefully removed my Bitstream to make room for Glyphix, thinking that if it did not work out, I could go back to the Bitstream. But I will not go back." Lorne Bowerman, R&L MicroServices Inc. ■ "As a WordPerfect certified instructor, I feel that all my students should know about your program and I make a point to mention it." Don Williams, Computer Learning Centers of America. ■

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TECHNICAL REQUIREMENTS IBM PC, AT, XT, PS/2 or compatible with a minimum of 512Kb RAM, a hard disk, MS-DOS 3.0 or later, a LaserJet Plus Series II or compatible printer with 512Kb of printer memory

Glyphix, Helvenica, Garamand, Tymes Roman, Oxford, Buckingham, University Ornate, Manuscript, Copperfield, Rockland, Exchequer Script, Avant Guard, Gibraltar, Bongo Black, Obelisk, Baskerton, Palatine, Eterna, Classic Typewriter and New York Deco are trademarks of SWFTE International Ltd. All other products are trademarks and/or trademarks of their respective manufacturers.

First Looks

HyperAccess/5: Automated Communications Made Easy for OS/2 and DOS

HANDS ON
by M. David Stone

For anyone who has been waiting for communications software for OS/2, a program with name recognition has arrived. But Hilgraeve's *HyperAccess/5* is noteworthy for DOS users, as well. The \$199 package includes OS/2 and DOS versions on 3.5- and 5.25-inch disks, respectively. While Hilgraeve continues to sell the older, DOS-only *HyperAccess*, that version differs from the new one in significant ways.

If you were hoping for a graphics-based program that would run under the OS/2 Presentation Manager, you'll have to wait a little longer: *HyperAccess/5* runs strictly in character mode. In fact, the DOS and OS/2 versions of the program look essentially identical, with the same menus, options, and Alt-key commands.

In both variations, *HyperAccess/5* offers a full complement of features, including 14 terminal emulations, 7 file-transfer

choices, a rich script language, and a host mode. In its OS/2 version, the program takes advantage of OS/2's multitasking capability, letting you transfer files in background or run multiple sessions.

One of the few visible differences between the versions is an option in the OS/2 variant that sets aggressiveness. A high setting gives *HyperAccess/5* a higher priority than other programs running in the foreground and background, and it speeds file transfers when the program runs in the background.

Because background communications capability is most useful when fully automated, Hilgraeve's designers have concentrated on making *HyperAccess/5* simple to automate. But while the resulting design may have been driven by OS/2's multitasking potential, it offers rewards for foreground operation, even in DOS.

An innovative Learn mode not only memorizes your keystrokes, but also makes best guesses about why you typed what you did. For example, if you record an auto-login script and pick MCI Mail from your phone book by pointing to it with arrow keys, the program will not record your keystrokes as Up and Down Arrow keys. Rather, it will record the command to call MCI Mail specifically by name, just as if you had typed the name.

The Learn mode will also note where you were in the program when you started recording, and it will enter commands to bring you back there whenever you run the script. This lets you run any script from any location in the program.

For those times when the Learn mode's best guess isn't good enough, or when you want to add programming logic, you can modify a script with the

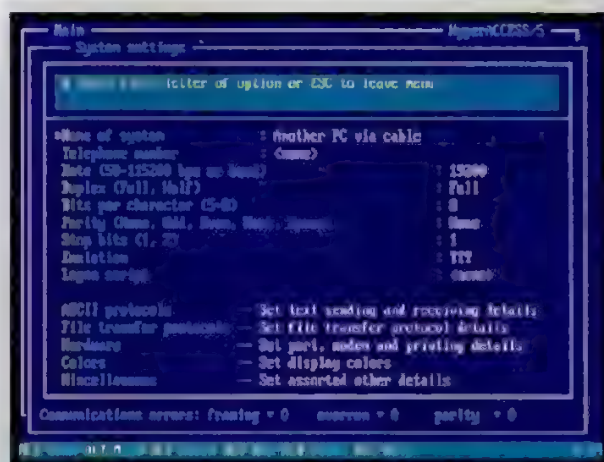
built-in editor. A set of script-management commands lets you delete, copy, or rename scripts. You also can assign a script to a shortcut key or reassign it to a different key.

On the PC Labs performance tests, *HyperAccess* long ago proved to be one of the fastest performers in file transfer. *HyperAccess/5* remains true to form. File-transfer time with the proprietary HyperProtocol was about 113 seconds for a 50,000-byte file for both DOS and OS/2 versions. That yields an effective transfer rate of 442 characters per second over a 2,400-bit-per-second connection.

turned off, the program clocked in at a still-impressive 213 seconds, or about 235 cps.

Unfortunately, *HyperAccess/5* has some notable flaws, a few of which are built into the program design. For example, the context-sensitive help isn't always available when you need it. In particular, when filling in a blank field, if you don't already know the available options, you have to back up to a previous menu before you can call up the help screen.

More troublesome, but hopefully temporary, is that the program simply isn't as stable as it should be. In testing for this



With instructions listed at the top and Alt-key commands specified along the bottom, *HyperAccess/5*'s system-settings screen makes it easy to issue commands.

According to Hilgraeve, HyperProtocol will even improve transfer rates when using MNP level 5 modems or V.42 bis modems, both of which already include data compression. The drawback is that you can't use HyperProtocol unless you have some version of *HyperAccess* on both sides of the link.

In addition to HyperProtocol, *HyperAccess/5* offers most of the common file-transfer protocols, among them Xmodem, Xmodem-1k, Ymodem (often called Ymodem batch), Ymodem-G, Kermit, and variations on CompuServe-B, including Quick B. It's worth noting that even using public-domain protocols, *HyperAccess/5* has generally managed to outpace the competition. Using Ymodem, and with data compression

review, the program blew up several times, in some cases forcing me to reboot. Hilgraeve promises to provide fixes free on request, but it would be better not to need them. Fortunately, all the flaws I found are related to ancillary functions, such as the built-in editor, so you can avoid problems during actual communications.

If you're using OS/2 and are desperate for a communications program, *HyperAccess/5* may be worth getting, even with the bugs. More generally, the program offers some innovative features that are truly praiseworthy. Once its problems are fixed, it should be a strong contender—particularly if you're using DOS now but plan to move to OS/2 in the near future. ■



FACT FILE

HyperAccess/5, Version 1.0
Hilgraeve Inc., P.O. Box 941,
Monroe, MI 48161; (800) 826-
2760, (313) 243-0576.

List Price: \$199; upgrade from
HyperAccess, \$49.

Requires: 350K RAM, hard
disk or one 720K floppy disk
drive, DOS 2.0 or later or OS/2
1.0 or later.

In Short: The first
communications program for
OS/2 offers full-function
communications and fast file
transfer. Even with bugs, the
program earns praise for
innovative features like its
Learn mode, which makes
automating communications
extraordinarily easy.

CIRCLE 434 ON READER SERVICE CARD

The Big Guys Still Can't Figure Out How We Do It.

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M.I.P.S. Magazine, October 1989

"...the 33/D's 90M-byte hard drive and controller completed a series of tasks—file generation, indexing and sorting—four times faster than Compaq Computer Corp.'s Deskpro 33/386..."

P.C. Week, August 14, 1989

"The SmartCache's usefulness is attested to by the (Fivestar) Model 33/D's excellent performance in the disk I/O benchmarks."

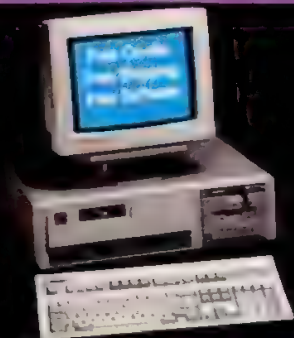
BYTE Magazine, Fall, 1989

The industry big boys and publishing heavyweights all seem to agree...Fivestar's combination of smart price, gutsy performance and risk-free support may be hard to figure, but the end user is the clear winner.



Fivestar Computers. Smart price. Gutsy performance. Risk-free support.

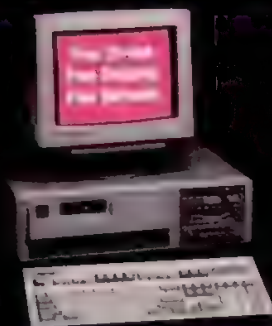
At FIVESTAR, price and performance are just the beginning. We are committed to providing the best overall customer protection package available. That's why we include a full one year on-site GE Computer Service contract, free shipping, a 14-day money-back guarantee, a lifetime toll-free customer support hotline and our promise of 100% customer satisfaction. GUARANTEED.



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- 1.44MB 3 1/2" DRIVE
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- 16bit VGA CARD
- 14" VGA COLOR
- 1 PARALLEL & 2 SERIAL PORTS
- 101-KEY KEYBOARD
- MS-DOS 3.3 or 4.01
- FREE 1 YEAR ON-SITE SERVICE
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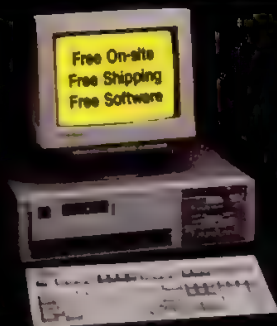
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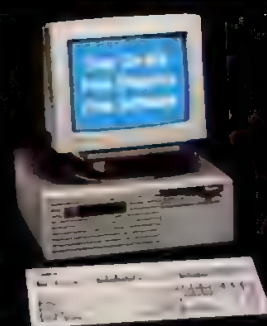
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First Looks

Polymod2 Provides Low-Cost Means Of Sharing OS/2 Applications

With *Polymod2*, DOS and OS/2 can have a peaceful and productive coexistence. The \$1,600 program makes it possible to attach multiple DOS-based PCs to an OS/2 host, allowing you to hotkey between OS/2 programs and local DOS applications. DOS applications are put on hold when you run OS/2 programs on the host.

Polymod2 supports dumb terminals and PC compatibles running in terminal-emulation mode under DOS. The program lets up to 99 terminals be connected to an OS/2-based host via RS-232 cables, allowing them to use OS/2 character-mode applications. Terminals can share printers attached to the host, as well as continue to use their own local printers.

The *Polymod2* terminal-emulation software requires 30K

system by redirecting and managing I/O traffic that would normally go to the keyboard and screen of the host.

But before you get all worked up over the prospect of multiuser OS/2, you should consider two points: since all but the most expensive terminals can't handle color graphics, you'll have to forego dazzling displays and make do with OS/2 character-mode applications (The Software Lifeline, which distributes the program in the U.S. for Memsoft S.A., provides a list of 20 *Polymod2*-compatible OS/2 applications). In addition, you'll have to make sure that the developers of the OS/2 applications you want to use have provided the read/write protection required for multiuser operations.

We encountered no problems when we ran *WordPerfect for OS/2*, a character-based application, on multiple worksta-

Polymod2 allows system administrators to log on to the host or any terminal and access the *Polymod2* control panel to monitor system status and take control of applications. Administrators can also create macros under *Polymod2* menus to automate tasks.

An easy-to-use, mouse-compatible user menu lists optional applications. Users switch between multitasked applications and the menu with a Ctrl-Esc key combination. The option of seeing the OS/2 command prompt in full-screen mode gives users the ability to easily maintain their directories and files. Access to the OS/2 DOS compatibility box is not available from the terminals.

Polymod2's security features—optional user passwords and user-specific access controls for up to 24 applications—are quite good. PCs cannot access local drives while in terminal-emulation mode, thus ensuring that sensitive data won't walk out the door on floppy disks.

System administrators can monitor the activities of any station by listing the log-on and log-off times of all users and the programs and files in use on each terminal. They can also look at a "snapshot" of the display on any terminal and have the option of stopping the execution of any application a user is accessing.

The manuals that come with *Polymod2* have good content outlines, and although they lack indexes, it's not difficult to find the information you need. There are manuals for host-computer installation and setup and for setup of PC, IBM, and Wyse terminals; the manuals include sections on cable configuration and diagnostics.

If you're the system administrator, there's one manual that you had better not lose, since *Polymod2* uses it—as well as

passwords—as part of its copy-protection scheme. Upon start-up, *Polymod2* occasionally will ask you to enter a code for a random colored block that appears in this manual. This form of copy protection does not impede data backups and restoration, but it does mean that you shouldn't let that manual stray far from the host computer.

Of course, when you share a host, no single terminal gets the full benefit of its processing power, and when you route I/O requests through slower RS-232 channels, you get slower responses. As a result, it would be realistic to expect *Polymod2* to provide acceptable performance for three to eight active terminals (depending on the applications being used), in spite of its ability to support up to 99 terminals.

At this time, the best use for *Polymod2* is as a means of sampling OS/2 applications for organizations that want to forestall the cost of adding hardware. The program's inability to send graphics screens across the RS-232 line may preclude using some of the most creative, desirable, and aesthetically pleasing OS/2 programs. Still, for organizations that can make do with character-based applications, *Polymod2* is an ideal portal to OS/2. ■

The *Polymod2* program selector screen shows the many configuration and control options open to the user.



RAM and can be loaded as a TSR or a foreground application. The program supports IBM 3151 or 3161, Wyse 50 or 60 (with AT3 keyboard), Ampex, and Kimtron KTP70 terminals, as well as IBM PCs, XT's, AT's, PS/2's, or compatibles with monochrome or color monitors.

Since OS/2 already provides for multitasking, *Polymod2*'s job is simply to give multiple users access to the operating

tions. When we tried to preview a *WordPerfect* file in graphics format before printing, *Polymod2* handled that error well, informing us of a graphics-mode incompatibility.

Polymod2 installation and setup tasks are completely menu-driven. The program's function-key assignments and pull-down menus are so well designed and easy to access that using a mouse with this program seems to slow you down.



FACT FILE

Polymod2

Memsoft S.A., The Software Lifeline Inc., Fountain Square, 2600 Military Trail, #290, Boca Raton, FL 33431-6358; (407) 994-4466

List Price: \$1,600.

Requires: 2MB RAM, 1MB hard disk space, serial ports or intelligent Multiport cards, IBM or Microsoft OS/2 1.0 or later. Copy protected.

In Short: Makes OS/2 a multiuser, multitasking system for up to 99 ASCII terminals or DOS-based PCs. Features access to remote files, remote program execution, spooled printers, remote interprocess communications, distributed database access, and user-level log-on features for the end-user terminal. Does not support full graphics modes.

CIRCLE 437 ON READER SERVICE CARD

First Looks

For Statistical Analysis, SPSS for OS/2 Brings Mainframe Power to the PC

HANDSON
by Barry Simon

No type of software has suffered more because of DOS's 640K barrier than high-end mathematical and statistical programs. Vendors of the first wave of mathematical packages got around this constraint by having their programs use DOS extenders on 386-based machines. SPSS has taken a different strategy: its \$995 statistical software program *SPSS for OS/2* uses that operating system instead of a DOS extender to break the 640K barrier.

SPSS is a major supplier of statistical software on a wide array of computing platforms. Its *SPSS/X* has long been a standard on a variety of minicomputers and mainframes, and *SPSS/PC+* was one of three Editor's Choice selections in our last roundup of high-end, PC-based statistical packages ("Statistical Software for the PC: Testing for Significance," *PC Magazine*, March 14, 1989). With the release of *SPSS for OS/2*, the power of *SPSS/X* has migrated down to desktop machines. And because it uses the facilities of the OS/2 Presentation Manager, this more powerful program is easier to work with than its DOS sibling.

Like its DOS counterpart, *SPSS for OS/2*'s hard disk requirements are substantial. You'll need 6MB of hard disk space for the base system and 16MB of storage for all the modules. The overall structure of *SPSS for OS/2* will be familiar to users of *SPSS/PC*. Like the DOS version, the new program is composed of three basic parts: an input area, in which commands are entered, edited, and executed; an output area, which displays the results of commands; and a command generator, which tames the

command line.

The command generator for both the DOS and OS/2 versions is a hierarchical menu, with a window describing the highlighted menu choice. As you choose a command, the next level of the menu shows you required and optional parameters, and as you choose them, the command is entered for you in the input area. In this way, you build the complicated commands that the SPSS language requires.

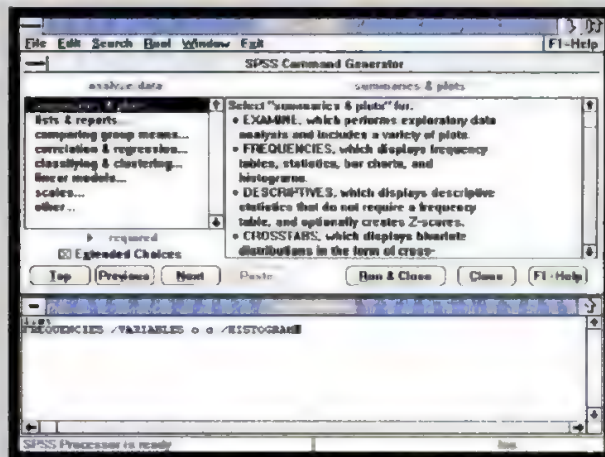
Though the similarity between the two versions goes a long way toward bringing DOS users up to speed quickly, graphical user interface concepts add considerable ease of use to the OS/2 product. Rather than have output displayed in terminal mode with a "MORE" prompt for each screen that has

get a standard PM filename dialog box. And you can zoom in on various windows to display extra information.

Still, the interface could stand improvement in spots. For example, the command that loads an ASCII data file does not call up a file dialog box, although the commands that load an *SPSS* data file or import a *.WK1* or *dBASE* file do. And when the command generator is active, you must run the program either as an icon or in full-screen mode without access to other windows.

If you're a command-line fanatic or just aren't keen on GUI concepts, you'll probably want to use the version of the program that features a bare command line running in an OS/2 text-mode session. For repetitive batch procedures, this type of interface is very efficient.

User-interface issues aside, the real excitement is the program's mainframe power. Among the things that *SPSS for OS/2* can handle are large data sets. You're not limited to working with 500 variables—you can use as many as 32,000. You can analyze hierarchical data files, such as those from a



SPSS for OS/2's command generator is a hierarchical menu that offers help and actually enters commands for you.

scrolled out of view, the OS/2 version has scroll bars that let you see what has disappeared from sight. Rather than forcing you to memorize filenames for loading a command or *SPSS* data file, the new version allows you to call up a menu item and

census, with each file including household data and data for several individuals.

The program offers sophisticated procedures like survival analysis, and, even more significantly, provides a powerful macro language. None of these



FACT FILE

SPSS for OS/2, Version 1.0
SPSS Inc., 444 N. Michigan Ave., Chicago, IL 60611; (312) 329-3500.
List Price: \$995 for the base system; Trends, Tables, and Advanced Statistics modules, \$495 each. Upgrades for Value Plus customers of *SPSS/PC+*: base system, \$200; modules, \$100 each.
Requires: 3.5MB extended memory (6MB recommended), 6MB to 16MB disk space, OS/2 1.1 or later; mouse recommended.
In Short: The power of a mainframe for statistical analysis comes to the desktop. Handles large data sets, analyzes hierarchical data files, and offers a powerful macro language.

CIRCLE 433 ON READER SERVICE CARD

features are included in the DOS version.

Multithreading is a pleasure with *SPSS for OS/2*. You can send the program off to do some calculations and start formulating your next command while the calculations go on in the background.

As with *SPSS/PC+*, the base system of the OS/2 version is reasonably priced. But by the time you add all the extra modules you might want, the cost is hefty. Three optional modules—Trends, Tables, and Advanced Statistics—are available for \$495 each, and SPSS plans to release Categories, Graphics, and Data Entry modules.

The DOS version of *SPSS* has seamless links to *Microsoft Chart* and supports *Harvard Graphics* and *Draw Applause*. As of this writing, no presentation graphics programs were available for OS/2, but SPSS anticipates a presentation graphics solution within six months of the program's release, either through a port of its Unix-based graphics module or through a third-party program. In the meantime, you can produce histograms and simple bar graphs via the base system.

What all this adds up to is mainframe statistical analysis power for the desktop. You may wonder how you ever got things done in 640K. ■



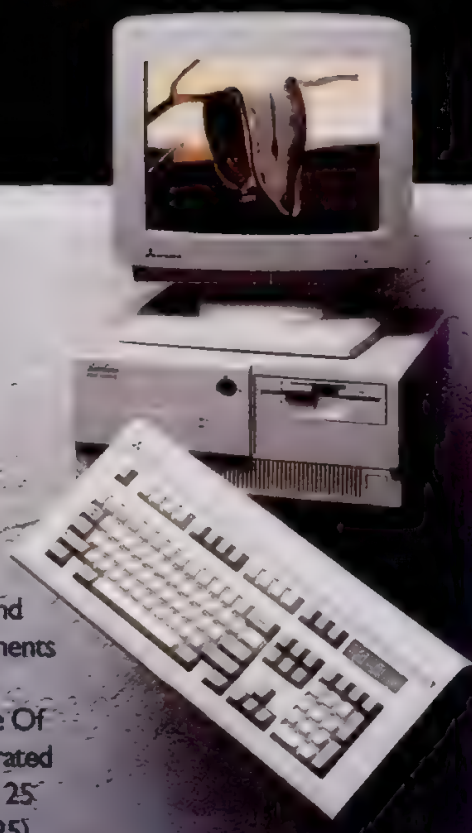
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CIRCLE 368 ON READER SERVICE CARD

First Looks

Desktop Set Dresses Up Windows with Powerful Desk Accessories

HANDS ON
By Nick Miller

New twists on *Microsoft Windows* are getting to be a dime a dozen these days, but few are as rich in features as *The Desktop Set*. Combining a collection of powerful desk accessories with an innovative desktop manager, this \$89 package brings real flair to the otherwise pedestrian *Windows* environment.

Desktop Set's desktop manager acts as an extension to the MS-DOS Executive. Once you've installed it, you'll find two extra menu entries on the active window—one a simple menu system for starting applications, the other a menu for managing your open windows. You can also use pop-up "expert menus" in place of the standard *Windows* menus. The expert menus demand less mouse movement and work even if all windows are iconized, but I found them too sensitive to positioning to be really useful.

The real timesaver is the facility that lets you perform operations such as calling up the Ex-

ecutive and iconizing the current window simply by moving the mouse to a corner of the screen. You'll soon wonder how you managed without it. As icing on the cake, you can do timed saves of your work and lock or blank your screen whenever you're not using it.

But the heart of *Desktop Set* is its assortment of desktop accessories, built around a well-integrated address book, calendar, and dialer, with a tape calculator and a file viewer thrown in for good measure. All are beautifully graphical, with pop-up menus and icons supplementing the standard *Windows* menus. Most can be password-protected, and all have much better printer, page-definition, and font support than their *Windows* counterparts.

The address book uses "pages" of entries for each letter of the alphabet that you leaf through by clicking on the "tabs" at the side of each page. But unlike a pocket address book, you can find the entry you want directly by selecting it from a list of entries, or by using the program's Soundex-based phonetic search capability.

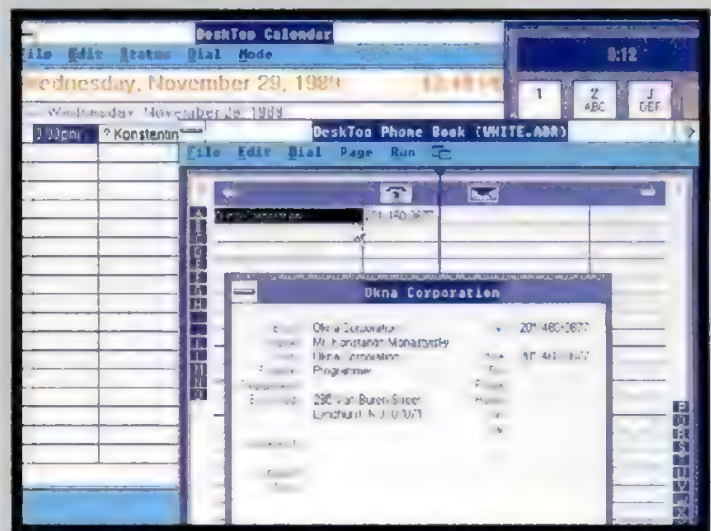
Each phone-book entry holds a variety of business and home information, and you can attach text notes (via the *Windows* Notepad) and data files such as spreadsheets to the entry. If several of your contacts work at the same company, you can link them to one "master" record, so that you can update all entries at once when entering address changes.

You can get information out of your phone book simply by copying it to the Clipboard. The selection and format of the data are defined in a customizable "template file"; you can even use this feature for quickie mail-merge letters. And for more-demanding jobs, the program has a well-designed import/export facility, though it handles only tab-delimited ASCII files. The phone book also supports DDE.

The calendar is simple but well designed. It makes good use of the mouse, so moving

handle international dialing codes and PBX prefixes of any complexity, and it can dial even after the receiving phone has picked up, so you can use it to operate touch-tone systems.

The other accessories pale a bit by comparison. The financial tape calculator has one memory register and does not support macros. Though the file viewer has a split-screen display and bookmarks and supports proportional fonts, it's not a replacement for the clunky old *Windows* Notepad. And the ru-



The *Desktop Set* offers an integrated group of accessories, including phone book, calendar, and dialer.

around between the daily, monthly, and yearly views is a snap. The expense-report view lets you define your own categories and total your daily expenses. When you make an appointment, you can link a person's phone-book record to it, so that the phone numbers and other information are always current. You can dial out directly from either the calendar or the phone book.

The dialer is less easy to master than the other accessories—its display is so deceptively simple that you really need to read the manual to find out the tricks to make it work. In return, it offers an amazing array of fancy features, including least-cost routing, support for calling-card accounts, and call logging. The dialer's setup options make it smart enough to

dimentary file manager looks and works like an afterthought.

The whole set could use a little more attention to nuts and bolts, as well. The bugs that marred earlier versions seem to have been eliminated, but some of the more recently added features don't always seem fully digested. Above all, the lack of on-line help is a real handicap; these programs are simply too richly layered and too feature-packed for most users to figure out on their own (the vendor says this help will be provided in a planned *Windows 3.0* version of *Desktop Set*).

Still, these are rather minor criticisms of a product chock-full of rewarding design ideas and insights. If you're in the market for *Windows* desk accessories, it's hard to do better than these.



FACT FILE

The Desktop Set

Okna Corp., 285 Van Buren St.,
P.O. Box 522, Lyndhurst, NJ
07071; (201) 460-0677.
List Price: \$89.

Requires: Microsoft Windows,
Version 2.1.

In Short: Attractive, feature-packed desk accessories and an innovative desktop manager make this product stand out. Though it is no substitute for file managers or menu systems, its integrated address book, calendar, and dialer accessories make a first-rate addition to any *Windows* desktop.

CIRCLE 436 ON READER SERVICE CARD

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First Looks

PrintRite: \$99.95 Spooler Affords Extensive Control Over Print Jobs

HANDS ON
By Rick Miller

If you've been pining for an industrial-strength print spooler, take a look at *PrintRite*. This \$99.95 program lets you print in the background, but it also gives you full control over your print jobs and sports flexibility and advanced features usually found only in networks and minicomputer spoolers.

A TSR that takes 50K of RAM, *PrintRite* captures output bound for your printer and compresses it into a spool file from which it's printed. (You can also spool up files directly from disk.) It works with both parallel and serial printers, though applications must print to a parallel device in order to be spooled.

Pressing a hotkey pops up a control panel that lets you hold, cancel, reprioritize, or edit the print parameters of any print job. You can also view the contents of the spool file or save them to an ASCII file on-disk for later printing. You can open and close spool files manually or let *PrintRite* take care of the job for you.

PrintRite is most notable for its advanced features. For instance, its named "style codes" let you select sheet-feeder bins, paper sizes and orientations, and so on by inserting printer control codes before or after each job. *PrintRite* also has a basic translation table for remapping graphics or foreign-language characters. Predefined settings are included for the most popular dot matrix and laser printers, and you can modify the settings using *PrintRite*'s setup utility.

If you often print invoices or other special forms, you'll be pleased to note that *PrintRite* lets you group all jobs of the same form type together. It can

even prompt you for forms alignment if you choose. In addition, its handy collation utility lets you print files back to front, a help if you have an old LaserJet that doesn't flip the pages as it prints.

Even with this wealth of features, *PrintRite*'s performance is still speedy. Files spool quickly, and the computer does not hesitate during background printing. Spool files can be kept on-disk until you delete them, so if the power fails or your printer jams, you can reprint them starting with any page.

Most PC print spoolers simply don't cut the mustard when



PrintRite lets you create style codes to issue before and after print jobs for such items as page size and orientation, type style, and print quality.

it comes to controlling your jobs. If you can afford the RAM, *PrintRite* is one that does, and well. ■

List Price: *PrintRite*, \$99.95.

Requires: 50K free RAM, DOS 2.0 or later. Bloc Publishing, 800 SW 37th Ave., #765, Miami, FL 33134; (305) 445-0903.

CIRCLE 447 ON READER SERVICE CARD

WinTrieve Adds Database Services to Windows Apps

HANDS ON
By Richard Hahn

Rather than investing the time and effort necessary to create your own file-handling libraries for *Microsoft Windows*, you can now use *WinTrieve*. The Whitewater Group's \$395 file manager for *Windows*.

WinTrieve provides file-handling libraries and a data server for *Windows*-based applications written in C or *Actor*, Whitewater's object-oriented development environment. The *WinTrieve* C library includes over 30 functions for manipulating data files and indexes, although an application can also utilize the server protocol directly. The *WinTrieve* *Actor* Class Library offers an object-oriented approach to data management that not only precludes having to learn C, but also requires less coding.

The *WinTrieve* server can manage data files for 20 application windows at a time. The server interface, based on the

X/Open data-management standard, includes journaling, table and record locking, and transaction processing, and it provides file management via ISAM (indexed sequential accessing method).

There are three ways to start the server: from the *Windows* command line, the MS-DOS Executive, or the *WIN.INI* initialization file. By providing the server as a separate application, *WinTrieve* can use the same body of code to serve more than one application at a time.

Each ISAM file consists of a data file with fixed-length records and an index file. The latter is composed of one or more indexes; each index key may be formed from parts of any field and stored in ascending or descending order. You can add and delete indexes as needed, use them for random and sequential access, allow for duplicate keys, and utilize compression to save disk space. In addition, the program lets you conduct partial or full-key

searches.

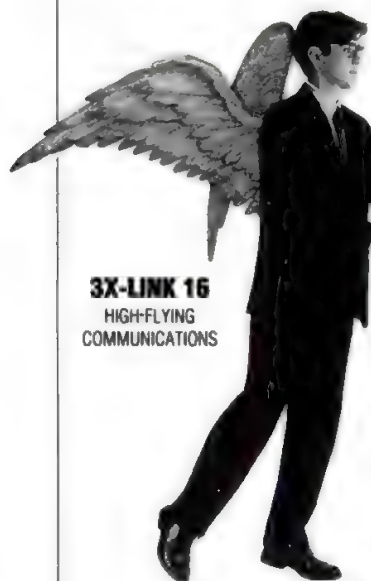
WinTrieve's transaction processing is reminiscent of SQL: you can start, commit, roll back, or end transactions. With journaling, you can track every data-file operation and run the journaled actions against a backup to restore a corrupted file.

WinTrieve uses about 140K of memory, although it can get by with as little as 65K. You'll need to install expanded or extended memory to use *WinTrieve* with *Actor* or large applications.

WinTrieve doesn't try to do everything: it provides only the most-necessary file-handling services. But *WinTrieve* will be a great help to *Actor* programmers, and other *Windows* programmers will find it invaluable until more file-handling systems for *Windows* become available. ■

List Price: *WinTrieve*, \$395.
Requires: *Microsoft Windows* 2.0 or later. The Whitewater Group Inc., Technology Innovation Center, 600 Davis St., Evanston, IL 60201; (312) 491-2370.

CIRCLE 448 ON READER SERVICE CARD



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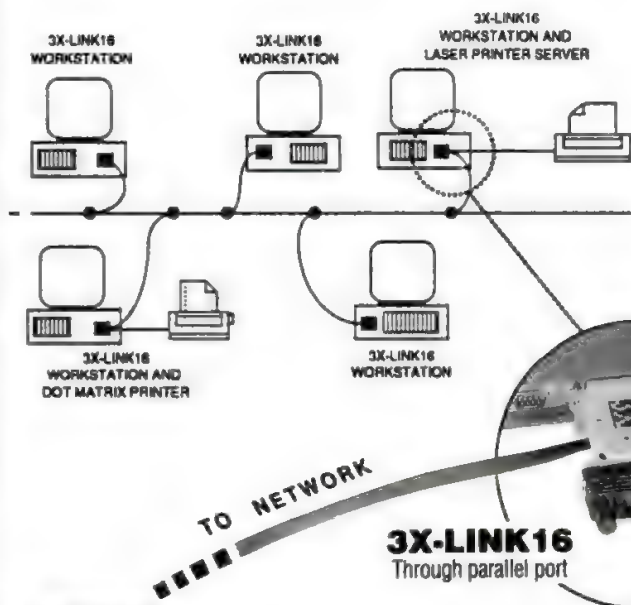
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First Looks

Rescue Plus Saves 1-2-3 Files from Accidental Deletion or Corruption

HANDS ON
by Craig Stinson

If it saves your data only once, Intex Solutions' *Rescue Plus* may still earn its place on your shelf of spreadsheet software. The \$119.95 set of six utilities provides several forms of disaster insurance for *Lotus 1-2-3* and *Symphony* users. Version 1.2 supports editions of *1-2-3* up to Release 2.2.

Rescue Plus puts together spreadsheet files that have sustained internal damage but are still whole as far as your directory and FAT are concerned. If *1-2-3* or *Symphony* won't load your worksheet, but DIR says it's there and CHKDSK says it's healthy, *Rescue* will come to your aid. It will analyze what's left of your file and restore it to a format that *1-2-3* or *Symphony* recognizes as valid.

Rescue isn't clairvoyant, of course; if the gremlins chew up a range of labels in the middle of your sheet, you'll need to reconstitute them yourself. In an effort to assist you, *Rescue* will generate a "decode report," showing the record structure of your file after *Rescue* has patched it and indicating the byte locations of damaged data areas. Since the damaged spots are not keyed to row-and-column addresses (why they're not isn't clear), the report may be of little value to you. But it's probably better than nothing.

Three of the program's utilities—*Resqdisk*, *Resqview*, and *Resqfile*—constitute a FAT-patching and file-resurrection facility. The advantage to using these programs—instead of one of the popular general-purpose undelete utilities—is that the *Rescue Plus* set knows all of the Lotus data-file formats and can usually guide you from cluster to cluster as you restore your erased file. It therefore stands a good chance of stitch-

ing the pieces together, even when they're scattered all over your disk.

A fourth utility, *Resqpass*, is a Lotus password decrypter. Forget your password? Just run *Resqpass* and all will be revealed.

Guardian, a newcomer to the suite, is an add-in that backs up your current worksheet at timed intervals. You can have it do its

work automatically or prompt you each time the interval elapses. You can also set it up to make backups each time you load or save a file.

These are not elegant programs. With the exception of *Guardian*, they suffer from an inconsistent user interface and weak documentation. There's nothing wrong under the hood, but the exterior needs more than a touch of paint. None of the programs accepts command-line parameters. The reports generated by *Resqdisk* are so primitive they don't even include column headings.

In addition, *Rescue*'s decode file will be meaningless to almost everyone except Lotus employees and those who have

read up on the internals of Lotus worksheet files. *Resqdisk*, *Resqview*, and *Resqfile* should be integrated into a single program with a friendly menu and a help system.

But if they work, who cares? Recommended for *1-2-3* and *Symphony* users who don't back up religiously and can't afford to lose data through file corruption, password amnesia, or accidental erasure.

List Price: *Rescue Plus*, Version 1.2, \$119.95; upgrade, \$45. **Requires:** 256K; *Lotus 1-2-3* 1A, 2.0, 2.01, or 2.2 or *Symphony*; DOS 2.0 or later. Intex Solutions, 161 Highland Ave., Needham, MA 02194; (617) 449-6222.

CIRCLE 432 ON READER SERVICE CARD

WordStar 5.5: New Features For Old Loyalists

HANDS ON
by Lawrence H. Mink

WordStar International's recent upgrade, the \$495 *WordStar*, Version 5.5, adds enough new features to let diehards convince themselves that their favorite program is equal to upstarts like *Microsoft Word* and *WordPerfect*. Because *WordStar* International knows that most of its sales will be to existing users, you can buy the upgrade from retailers—something you can't do with any other software.

The new version adds para-

graph styles that you can select by name, although these have far fewer options than the styles in other programs. You can now import data directly from *Lotus 1-2-3* worksheets, and a separate conversion utility for most other word processor formats comes in the package.

The new version is stuffed with other miscellaneous additions, including an awkward but integrated communications module, *WordStar*'s standard mail-merge, plus *PC Outline* and the screen-capture program *Inset*. You can insert and edit

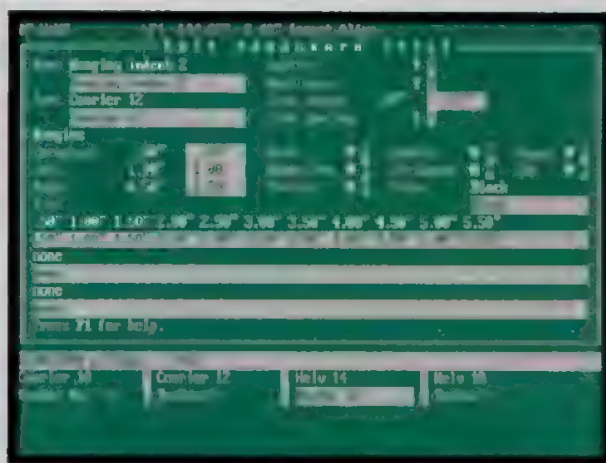
graphics via *Inset*, but it's still a separate program grafted onto *WordStar* instead of an integrated set of graphics features.

As in the last version, the unique page preview displays multiple pages and close-up views of any part of a page, including the true shapes of any bitmapped LaserJet fonts. PostScript typefaces aren't displayed accurately, and PostScript printing is so awkwardly supported that you have to install any point size you want to use that isn't among the few sizes listed on the menu.

WordStar still won't format an imported file until you give a special command, and you still have to issue a command to reformat text after changing a margin. Justified text entry is slow, even at 16 MHz. Initial installation is well automated, but any changes afterwards send you down a maze of interlocking programs that *WordStar* International should consider marketing separately as a text adventure game.

List Price: *WordStar*, Version 5.5, \$495; upgrade from Version 5.0, \$89; upgrade from versions prior to 5.0, \$119. **Requires:** 384K RAM (512K RAM and graphics adapter for page preview), two disk drives, DOS 2.0 or later. *WordStar* International, 33 San Pablo Ave., San Rafael, CA 94903; (415) 499-1200.

CIRCLE 433 ON READER SERVICE CARD



Wordstar, Version 5.5, includes named paragraph styles that can be chosen or modified from a menu.

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by
Alan Cohen

New & Improved

News of Announced Products and Upgrades

Laser Printer Eases Bar-Code, Label-Printing Hassles

NEW

Designed to bypass the paper-handling shortcomings of single-sheet laser printers, **Output Technology Corp.**'s **LaserMatrix 1000** is a continuous-form desktop laser line printer that boasts a speed of 1,000 lines per minute, according to the company. The \$7,995 desktop printer is expected to ship in the first quarter of this year.

Aimed primarily at the bar-code and label-application market, the **LaserMatrix 1000** features an adjustable tractor feed that can be set to any width between 3.5 and 9.5 inches. This allows for the smooth feeding of various labels and paper stocks. The printer also includes a built-in scalable font that can print in any point size. And for those who need a variety of type styles, two cartridge slots allow access to the Hewlett-Packard-compatible font library.

Built-in printer emulations include HP 2563B, LaserJet Series II, Ruggedwriter, and IBM Proprinter. A DEC-compatible version features LG02 and LN03+ emulations, as well as Tektronix 4010 and 4014 modes.

List Price: LaserMatrix 1000, \$7,995. Output Technology Corp., E. 9922 Montgomery, Spokane, WA 99206; (800) 468-8768, (509) 926-3855.

CIRCLE 440 ON READER SERVICE CARD

SyQuest Develops 3.5-inch Removable Cartridge Drive

NEW

The SQ355, from **SyQuest Technology**, is a removable-media 3.5-inch Winchester disk drive for OEMs to install in laptop, portable, and desktop PCs alike. The 42MB unit, which weighs all of 3.1 ounces, features an average seek time of 19 milliseconds, accord-

CONTINUES ON PAGE 54



When used with bar-coding software, the LaserMatrix 1000 outputs high-resolution, industry-standard bar codes, according to the Output Technology Corp.

HOT PROSPECT

FORESIGHT RESOURCES' DRAFIX CAD DOES WINDOWS

For a while now, we've been able to do word processing in *Microsoft Windows*, we've been able to do page layout in *Windows*, and we've even been able to play some games in *Windows*. Now, thanks to **Foresight Resources Corp.**, we can roll up our sleeves, grab a mouse, and do some computer-aided design with it.

Drafix Windows CAD (\$695) features a full spectrum of drawing, editing, and manipulation tools, including associative hatching, fills, and dimensioning. An attribute system annotates images, and user-defined text and numeric values can be assigned to symbols, lines, and arcs. Up to 60 attributes can be assigned to each symbol or entity.

A library of over 400 predrawn symbols is included with the package, and users can build their own libraries. **Drafix Windows CAD** also includes the **Drafix Graphic Language**, which processes graphics commands in a C-style control flow.

Drafix Windows CAD provides compatibility with .DXF files and supports HPGL; data can also be exported to *Microsoft Excel*. The program allows for up to four independent "viewports," or windows. Changes made in one viewport are immediately displayed in the others. Horizontal and vertical scroll bars are provided for each viewport.



Drafix Windows CAD can simultaneously display up to four independent views of a drawing.

List Price: **Drafix Windows CAD**, \$695; Professional Symbols libraries, \$150 each. **Requires:** 286- or 386-based computer; 1MB RAM; one hard disk and one high-density floppy disk drive; EGA or VGA display; mouse or digitizing pad; *Microsoft Windows 2.1* or later, *Windows/286*, or *Windows/386*. Foresight Resources Corp., 10725 Ambassador Dr., Kansas City, MO 64153, (816) 891-1040.

CIRCLE 439 ON READER SERVICE CARD

New & Improved

SyQuest SQ355

CONTINUED FROM PAGE 53

ing to SyQuest.

The SQ355 can be equipped with either a 16-bit AT interface or an embedded SCSI controller. Cartridges used with the system can be interchanged between AT and SCSI drives. Cartridge reliability in the SQ355 is enhanced through the use of ramp-loaded read/write heads that retract from the disk surface when the drive is shut down and the cartridge is removed.

List Price: SQ355 removable-media disk drive, \$290 in OEM quantities. SyQuest Technology, 47923 Warm Springs Blvd., Fremont, CA 94539; (415) 490-7511.

CIRCLE 444 ON READER SERVICE CARD

Microtek Offers Low-Cost Color, Gray-Scale Scanner

NEW

For just slightly more than the price of a standard gray-scale scanner, PC users can now get their hands on a full-fledged color/gray-scale unit. The \$2,195 MSF-300Z Color/Gray scanner, from Microtek Lab, operates in three different modes: black and



The SQ355 features a low, 1-inch profile and uses a 5-volt power supply. Each cartridge stores 42MB of data.

white (1-bit), 256-shade gray scale (8-bit), and full color (24-bit).

The scanner, which supports both the IBM and Apple Macintosh platforms (depending upon which interface package is purchased with the unit), comes bundled with editing and retouching software. For the IBM, these packages include Microtek's *EyeStar Plus*, for black-and-white editing and painting; Astral Development Corp.'s *Picture Publisher*, which handles 256-shade gray-scale editing and photo retouching; and Microtek's *PC ScanShop—Color*, for full-color scanning and editing.

List Price: MSF-300Z Color/Gray scanner, \$2,195; interface kit for IBM PC or compatible (including interface card and bundled software), \$400. Microtek Lab Inc., 680 Knox St., Torrance, CA 90502; (213) 321-2121.

CIRCLE 441 ON READER SERVICE CARD

LAWN Takes the Wires Out of Connectivity

NEW

O'Neill Communications' LAWN, a "plug-and-play" Local Area Wireless Network, is based on high-frequency spread-spectrum radio transmission. A LAWN unit attaches to an RS-232 serial port and comes with menu-driven software that provides electronic mail, file transfer, and peripheral sharing. The unit is aimed at small businesses and workgroups that have previously avoided networking.

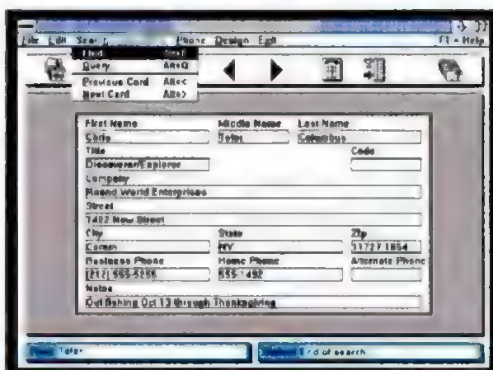
LAWN requires no wiring between units.

CONTINUES ON PAGE 50

IMPROVED

SideKick for Presentation Manager, Version 2.0—The new release of Borland International's *SideKick for Presentation Manager* features multiuser capabilities, password protection, customized views, font support, and resizable windows. The package, Version 2.0, is based on the forthcoming *Paradox* engine and generates *Paradox* tables that can be shared in a multitasking, multiuser environment. Because *SideKick for PM* stores its Time Planner and Phonebook applications in *Paradox* tables, multiple users can simultaneously access and update these files. The package also allows users to edit data within table views. *SideKick for Presentation Manager*, Version 2.0, is available now and retails for \$199.95. Registered users of the earlier release can upgrade for \$59. Borland International Inc., Scotts Valley, Calif.; (408) 438-8400.

NEC UltraLite—NEC Technologies' upgraded version of its UltraLite laptop computer includes a removable battery pack, which provides up



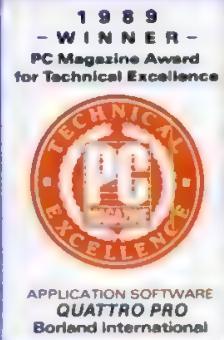
SideKick for Presentation Manager, Version 2.0, features enhanced search capabilities.

to 2 hours of power on a single charge. Current UltraLite owners should call their nearest NEC regional service center to arrange to have their unit retrofitted with the new battery. Retrofitted UltraLites will be returned by overnight delivery, and the cost for the complete installation (including battery, parts, labor, and shipping) is \$59. Additional batteries are available to all UltraLite owners for \$119 per pack. NEC Technologies Inc., Wood Dale, Ill.; (708) 860-9500.

Direct Access, Version 5.0—Delta Technology International's latest release of its PC-based menuing system features an automatic menu-building feature that reads a hard drive, identifies the software packages located there, and then groups these packages into logical menus. *Direct Access*, Version 5.0, then allows the user either to accept this menu setup as configured or to customize the menu selections. The package also offers a virus-detection capability and mouse support for point-and-

CONTINUES ON PAGE 50

BORLAND'S NEW SPREADSHEET



THE BALANCE OF POWER: QUATTRO® PRO

	QUATTRO PRO*	Lotus 1-2-3* v 2.2 v 3.0	
PUBLISHING			
3-D Graphs	✓		
Built-in draw package	✓		
Individual cell font control	✓	✓	
Shading and borders	✓	✓	
Print graphs & spreadsheets side-by-side	✓	✓	
CONSOLIDATION			
Multiple spreadsheet windows	✓		✓
Multipage consolidation	✓		✓
Keyboard and mouse support	✓		
Lotus 1-2-3 v 2.01 compatibility	✓	✓	✓
Spreadsheet Capacity (NSTL)**	640K RAM 11 18	8 12	NA 5
Price***	\$495	\$495	\$495

*Clip art from PicturePaks™ by Marketing Graphics Inc. (MGI)**NSTL (National Software Testing Labs) measured spreadsheet capacity by counting how many years of data could be added to a spreadsheet. Large numbers mean greater capacity. Performance for v 2.2 is with Always attached.
***Based on suggested retail prices as of October, 1989.

"QUATTRO PRO seems to do the impossible: It maintains compatibility with 1-2-3; adds functionality that no version of 1-2-3 has and still runs large spreadsheets in 640K."

PC WEEK, September 4, 1989

"Borland squeezes such features as multipage consolidation, advanced linking, and live graphics into a package that runs on 512K systems with its Virtual Real-Time Object-Oriented Memory Manager (VROOMM™) technology."

InfoWorld, September 4, 1989

QUATTRO PRO, with a unique balance of power, does both advanced publishing and multipage consolidation.

Lotus 1-2-3's Release 2.2 cannot do both. Neither can their Release 3.0 (see comparison chart).

QUATTRO PRO is compatible with 1-2-3.* It comes with a built-in draw package, clip art library,* and Bitstream® typefaces for presentation-quality output.

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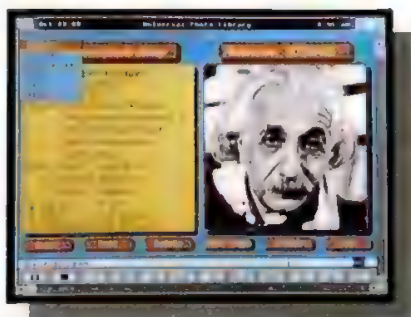
BORLAND

CODE: MQ24

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CIRCLE 377 ON READER SERVICE CARD

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The benefits of graphical user interfaces (GUIs) are dramatic. Consistency. Ease of learning. Presentation quality output.

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CIRCLE 136 ON READER SERVICE CARD

**Precision
Software**

New & Improved

IMPROVED

CONTINUED FROM PAGE 54

click selection of menu choices. *Direct Access*, Version 5.0, retails for \$89.95. Current owners should contact the company for upgrade details. Delta Technology International Inc., Eau Claire, Wis.; (800) 242-6368, (715) 832-7575.

QAPlus, Version 4.2—The enhanced release of DiagSoft's diagnostic software package automatically identifies processor and bus types, so a single version can be used on all PC systems, including those that run OS/2, Unix, or Xenix. Version 4.2 of *QAPlus* is self-booting and it checks the processor, the DMA/MCA channels, and the interrupt controllers, as well as the protected-mode operation on 286- and 386-based systems. On-line help is also provided. *QAPlus*, Version 4.2, retails for \$134.95. Current owners can upgrade to the new release for \$25. DiagSoft Inc., Scotts Valley, Calif.; (408) 438-8247.



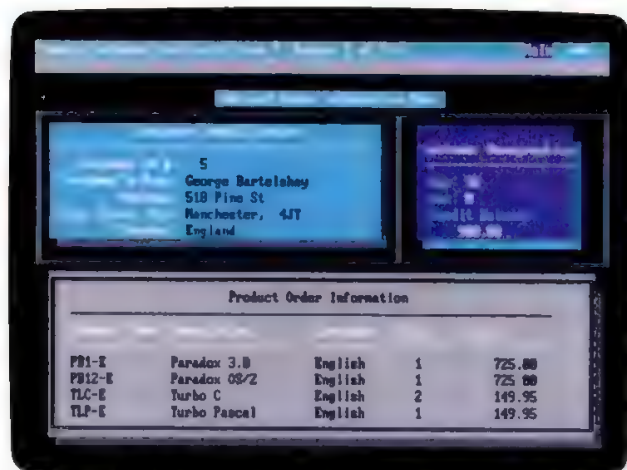
QAPlus, Version 4.2, will put your hard disk through a battery of diagnostic tests.

Baler XE—Owners of Baler Software Corp.'s *Baler*, Version 5.0, spreadsheet compiler will soon be able to upgrade to the company's new release, *Baler XE* (eXtended Edition). Whereas *Baler* 5.0 included a fixed library of built-in customization features, the new release allows developers to write their own additions to the library using BASIC or C programming languages. *Baler XE* also enables spreadsheet builders to add security and interface features to their programs. Furthermore, users can build "run" engines to make the most efficient use of system RAM, and nine new macro commands (including a DISPLAY macro for creating pop-up messages) are provided with the package. A dBASE-like input-validation procedure ensures accurate data entry into a baled program. *Baler XE*, which will list for \$795, is expected to ship in the first quarter of this year. Registered users of *Baler*, Version 5.0, may upgrade to the new release for \$300. Baler Software Corp., Hoffman Estates, Ill.; (800) 327-6108, (708) 490-5325.

PacificPage-IIP—An HP LaserJet IIP-compatible version of the PostScript emulation cartridge PacificPage is now available from Pacific Data Products. According to the company, PacificPage-IIP offers nearly twice the performance of the Series II version (due to the more efficient controller design of the IIP printer), generating print speeds of approximately 4 pages per minute (the LaserJet IIP's standard speed) when used with text-intensive applications. 2MB of printer memory is required. PacificPage-IIP retails for \$695. Pacific Data Products, San Diego, Calif.; (619) 552-0880.

System Sleuth, Version 2—Version 2 of Dariana Technology Group's diagnostic utility, *System Sleuth*, includes a System Resources option that presents detailed information about the PC's installed memory resources, including conventional, extended, XMS, and EMS memory. The improved *System Sleuth* also tracks hardware interrupts, displaying the status of each of the 8 (or 16) IRQ lines available. Furthermore, a new Memory Addressability evaluation performs tests on the auxiliary memory installed in a particular system. *System Sleuth*, Version 2, also allows users to add up to six other utilities to the main *System Sleuth* menu. Tools added in this manner appear as if they were part of the *System Sleuth* program, allowing users in effect to customize the package: *System Sleuth*, Version 2, retails for \$149. Current owners can obtain the upgrade for \$35. Dariana Technology Group Inc. (formerly DTG Inc.), Buena Park, Calif.; (714) 994-7400.

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✓ "Query-by-Example" for example

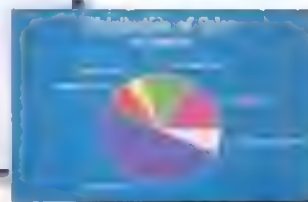
Use this checkmark and you're using QBE.

It's that easy. Let's say you need to know in a hurry which of your Los Angeles customers bought more than 5 pairs of white shoes. First ✓ the customer field, then type "LA," "white," and ">5," and you're done. Paradox gives you the right answer, right now. And how much programming to do all that? Zero.

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spreadsheet is the only program you've used before, Paradox gets you up and running immediately with just a ✓.

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Presentation-quality graphics are another Paradox distinction. They give you and your work the professional look.

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The Real Winner



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Code: MX08

BORLAND

CIRCLE 147 ON READER SERVICE CARD

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Only PreScript gives you *online printing*, letting you print without exiting your application. Only PreScript gives you WYSIWYG *preview* capability, so you can see your document on the screen exactly as it will print. Only PreScript gives you full page graphics without a printer memory requirement.

And PreScript runs up to five times faster than other solutions, particularly for graphics intensive pages and pages that switch fonts frequently. For even faster printing, an optional

PreScript interface card is available for use with the LaserJet Series II.

Plus, you get unlimited scalable, rotatable fonts along with all of the PostScript special effects, including support for powerful grey scale generation, character path, complex clipping, arbitrary image scaling and rotation, and curve drawing with flatness control.

PreScript requires no expensive printer controller. No extra printer memory. No external drivers. No soft fonts or font cartridges. No hidden costs.

So make your LaserJet take off for pennies. Power up with PreScript: 13 fonts (\$195); 35 fonts (\$395); optional interface card (\$295).

System requirements: 286 or 386 PC with 2 MB of extended memory; DOS 3.1 or higher; PreScript also works with the HP DeskJet and other HP-PCL compatible printers.

CIRCLE 342 ON READER SERVICE CARD

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PreScript™

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LAWN

CONTINUED FROM PAGE 54

According to the company, spread-spectrum transmission is an advanced form of radio transmission that provides added system security. It was originally developed for sensitive military communications.

List Price: LAWN, \$495 per node. **Requires:** 256K RAM, DOS 2.0 or later. Hard disk recommended. O'Neill Communications Inc., 8601 Six Forks Rd., Raleigh, NC 27615; (800) OCI-LAWN.

CIRCLE 442 ON READER SERVICE CARD

Axonix Provides Laptop Owners With a Hard Disk To Go

NEW

Axonix Corp.'s DataFile is a portable hard disk system for laptops that previously could not be upgraded to a hard drive, including the Toshiba T1000, NEC UltraLite, and Zenith MinisPort.

Featuring a high-speed parallel interface that connects to any standard parallel printer,



Measuring 2.75 by 5.3 by 8.3 inches (HWD), the DataFile connects easily to any laptop.

the unit delivers a data-transfer rate that is, according to Axonix, four times faster than serial-port hard drives.

The parallel interface also allows the DataFile to be moved easily from PC to PC. A key switch prevents unauthorized access. The unit comes in a number of configurations, with drive capacities of 20MB to 200MB, and weighs about 2.5 pounds. A 40MB model is available; others will ship later this year. An optional battery pack is also available. ■

List Price: DataFile, \$1,095 (40MB model). Axonix Corp., 2257 S. 1100 East, Salt Lake City, UT 84106; (800) 866-9797, (801) 466-9797.

CIRCLE 443 ON READER SERVICE CARD

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WEEK

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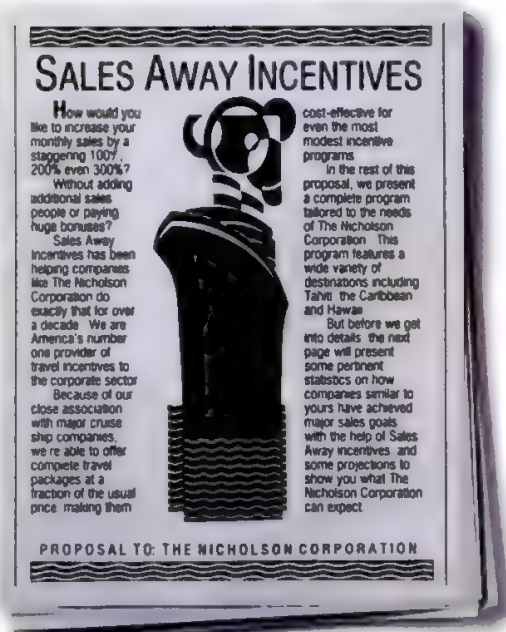
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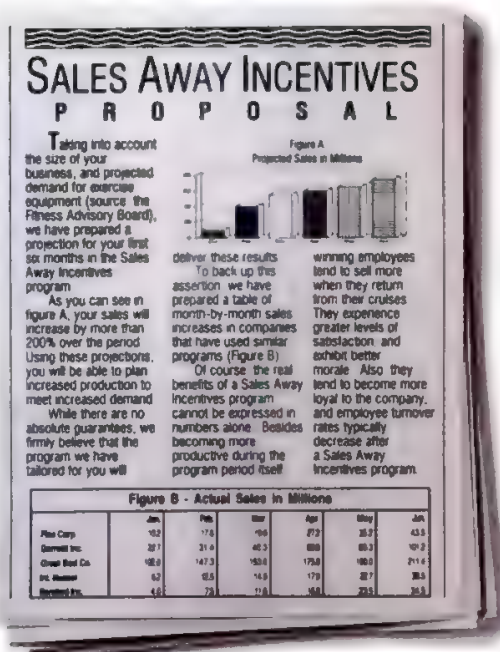
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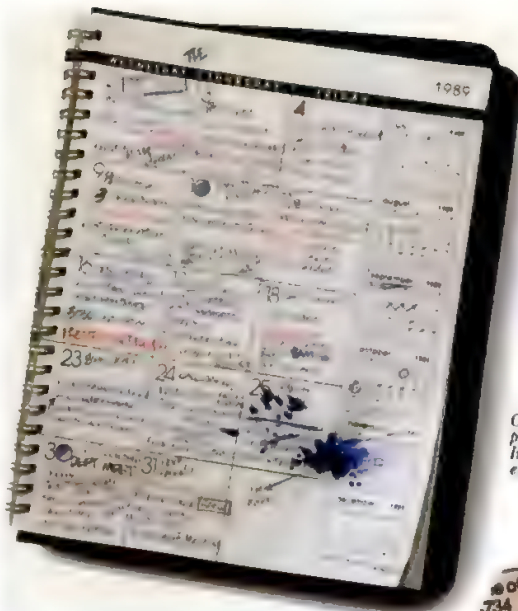
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CIRCLE 472 ON READER SERVICE CARD

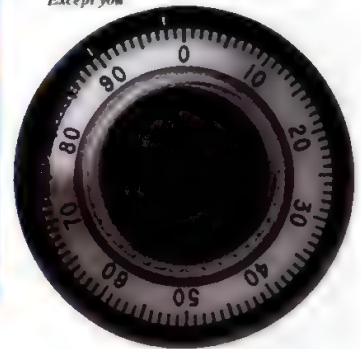


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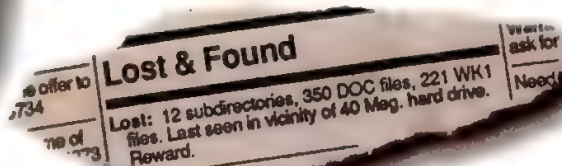
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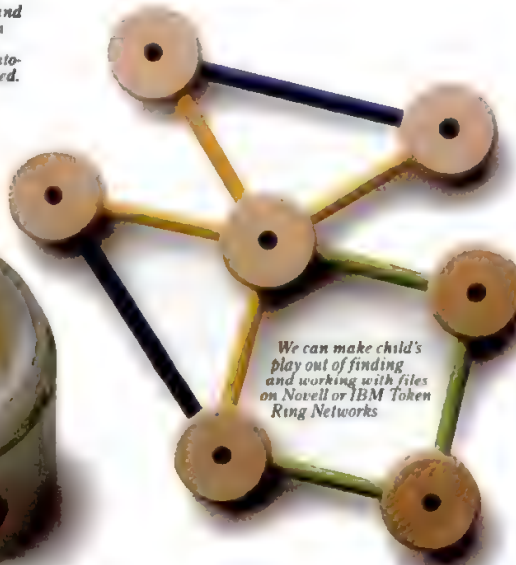
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PC Tools Deluxe 5.5

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Users of versions prior to 5.5, call (503) 690-8090 for upgrade details.



CIRCLE 749 ON READER SERVICE CARD

by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

Can Lotus and WordPerfect Put OS/2 "Over the Top"?

Lotus and WordPerfect are frustrated. They've accepted the IBM-Microsoft strategy of moving development of DOS applications to OS/2, and they've done all they could to get the text-based OS/2 versions of their top-selling programs to market. Yet when they look at why few of their customers are using the OS/2

versions of 1-2-3 and WordPerfect, they see *Windows* applications running on the 286 and 386 PCs that were supposed to be the platform for OS/2.

Lotus suspects it's been taken in by Microsoft, which is using the *Windows* wave to build market share for *Excel*. And now WordPerfect has

to wonder if Microsoft's upcoming *Windows* word processor isn't likely to make similar inroads into WordPerfect's territory.

Thus, out of self-defense was a new partnership born between two software leaders with little in common.

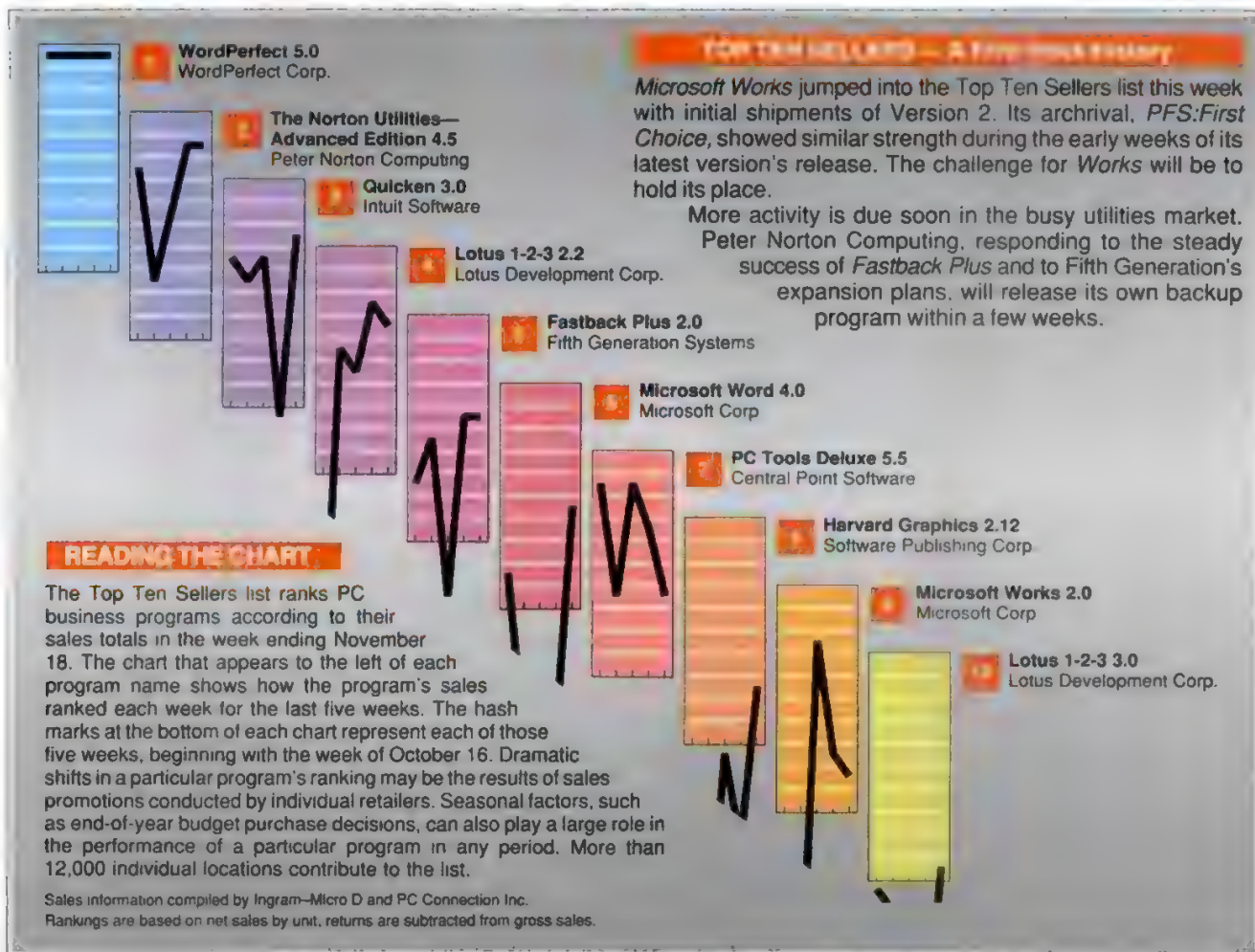
From a corporate standpoint, Lotus was an overnight success that developed a bunker strategy to preserve its market leadership, cautiously eyeing possible upgrades to its key

product as potential risks. WordPerfect, on the other hand, painstakingly built market share for its word processor with a pattern of frequent updates and obsessive attention to customer service.

Still, the two companies are coming together to assure the quick acceptance of their fully graphical OS/2 versions, due out in mid-1990.

Lotus has begun showing 1-2-3/G for OS/2 1.1 and later to its largest customers, and it

CONTINUES ON PAGE 64



Pipeline

CONTINUED FROM PAGE 63

will emphasize that dynamic links between *1-2-3/G* spreadsheets and *WordPerfect* for *Presentation Manager* documents will be easy to make. The links can be live, so a change made in a worksheet formula will be reflected in the stored version of a linked document. And because OS/2 is fully graphical, pasting between spreadsheets and documents is simple.

So far, the two companies haven't taken this partnership beyond a commitment to smooth the way for the graphical versions of their products. At the very least, this means the DDE hooks between the two will be guaranteed to work right out of the box.

One of the reasons they've run to each other for cover is that their OS/2 interfaces don't strictly match the IBM-defined CUA (common user access) standard that well-behaved OS/2 applications are supposed to respect. *WordPer-*

fect for *Presentation Manager* will use F2, not F1, as its help key; *1-2-3/G* will list Print functions from the main menu to match the DOS version, rather than branching Print off the File menu.

These are minor points that could get blown out of proportion in an all-out marketing war.

In addition, now that IBM has endorsed *Windows* for 286s with less than 2MB of RAM, Lotus fears its decision to ignore the *Windows* spreadsheet market will hurt it for many years. (*WordPerfect* is more cagey; it plans to cover both OS/2 and *Windows*.)

Pete Peterson of *WordPerfect* has said the two are collaborating to "see if together we couldn't push OS/2 over the top." He wouldn't say how far he's willing to take this alliance. After all, he has *DataPerfect* to sell, and Lotus has *Manuscript*.

It's still not clear what else

the two can—or want to—do together. But based on an early look, the two new versions seem to have all the snap, crackle, and pop needed to make the most jaded user jump for OS/2.

A new guarantee from Fujitsu may raise the profile of reliability promises.

Mac Stacks

Once the PC got its share of rich graphical environments, you knew it was only a matter of time before

the Mac's *Hypercard* explosion reached these shores.

Within a few months, Spinnaker Software Corp. will be distributing *Plus*, a *Windows* program that can run Mac-generated stacks. Many months ago, Spinnaker was close to releasing a similar product that became tangled in litigation. This program, developed in Germany, will be out soon after the next version of *Windows* is released.

Plus will be one of the early examples of application generation in *Windows*, which is likely to become an even

more explosive phenomenon on the PC than it's been on the Mac—especially when OS/2 versions of *Plus* and similar products come out later in 1990.

MTBF to Become New Marketing Weapon?

Manufacturers don't generally emphasize their MTBF (Mean Time Between Failure) stats, so it's difficult to compare one component's MTBF with a competitor's when making a purchase decision. And shopping for a good warranty is generally fruitless, since few computer parts come with warranties extending past one year.

But a new guarantee from Fujitsu may raise the profile of reliability promises. The company's newest 5.25-inch disk drives will come with five-year warranties and a huge 200,000-hour MTBF rating. (Hard disks usually rate no higher than 40,000 hours.)

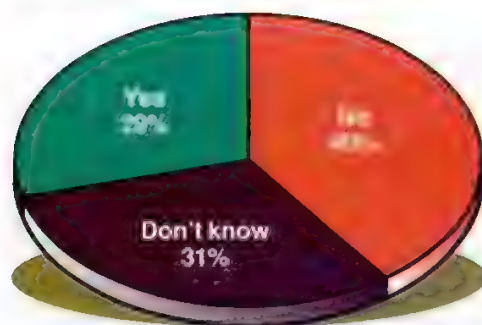
So far, Fuji's only putting the half-decade warranty on server-sized 778MB drives, but it's an encouraging development for consumers. ■



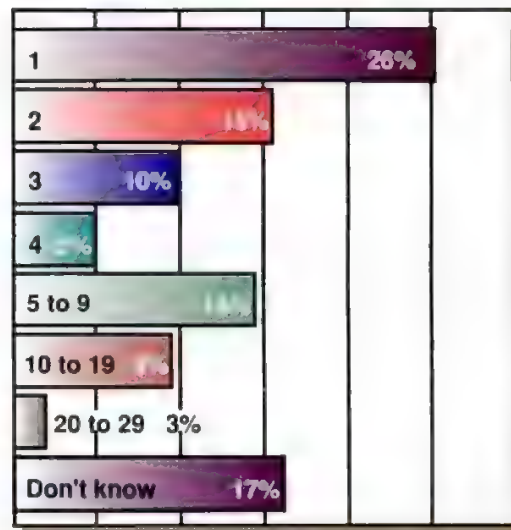
SURVEY

We recently asked callers to PC MagNet about minicomputers. Out of 1,600 respondents, half said that minicomputers were being used in their organizations. Among those whose companies had minicomputers in operation, the results were fairly well split when we asked whether replacements were being considered.

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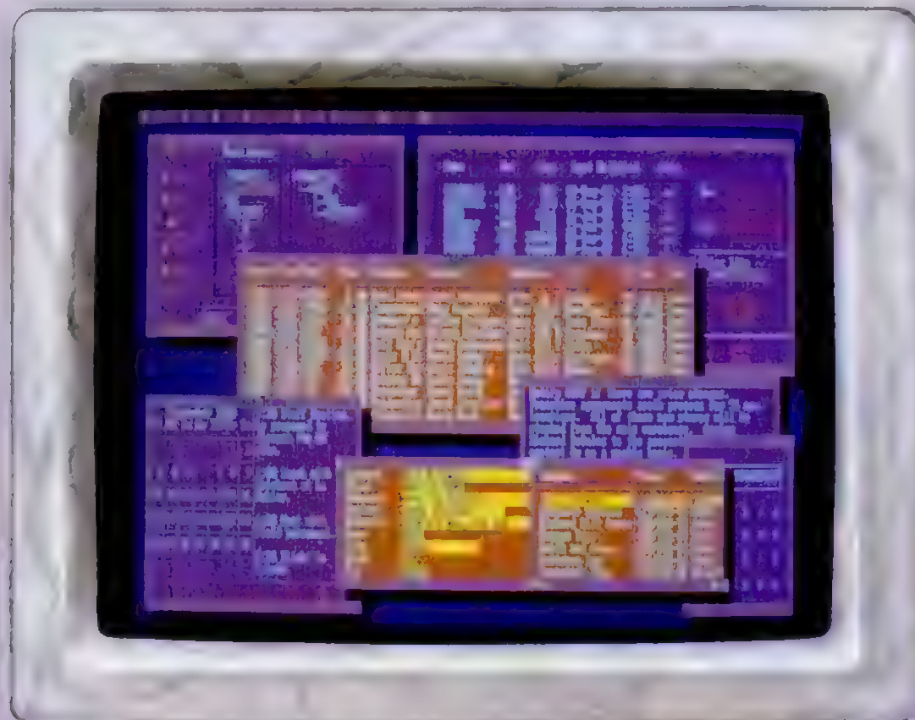
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CIRCLE 112 ON READER SERVICE CARD



Bill Machrone



For a handicapped person, a personal computer is more than just a tool; it can make all the difference.

Imagine being trapped inside your own body. Imagine having all your mental faculties, but being unable to move your limbs or even type on a keyboard. Imagine not being able to see, or having a visual impairment so severe that a screen is unreadable. Imagine the auto accident that has you coming back to work a few months later shy a couple of limbs.

This may be the stuff nightmares are made of for most of us, but for hundreds of thousands of handicapped people, it's part of their everyday struggle. Some are born with less than the full complement or usual scope of senses. Some lose mobility or senses to disease or accident. I know that if it happened to me, I'd certainly want everything that medical science and rehabilitation could do for my body. After that, I'd look for the next most beneficial device: a personal computer.

This column is not intended to be a how-dare-you-ignore-your-social-responsibilities tirade, nor a gee-look-what-they-can-do-with-computers-nowadays gush. Instead, I invite you to consider two things: the valuable contributions that handicapped people can make to the work force, and the growing number of products that can help them to do this. The federal government has long mandated equal access to the workplace for handicapped government workers, and it recently expanded that definition to include access to computer equipment on the job. Having the force of law behind this commonsense interpretation of the workplace has stimulated growth in the field of "assistive technology."

When I first started to investigate assistive technology, I was sure that I was the last person on the planet to hear about it. I was dismayed to find out that many computer-knowledgeable people, including those with disabilities, remain relatively ignorant of what's available. But I also discovered a number of user groups and support organizations on assistive technology, including special-interest groups within PC user groups and a burgeoning forum on CompuServe.

Today, OCR products such as Caere's *Omnipage*, which can read multicolumn pages with various typefaces (such as the pages of this magazine), have made it possible to break

through a formerly insurmountable limitation. *Omnipage*, however, runs under *Microsoft Windows*, which is a source of much debate among handicapped PC advocates—many of whom regard the burgeoning tide of graphical user interfaces as the worst possible news.

GRAPHIC THREAT

With the PC's architecture, any characters displayed on the screen can be read directly from the video adapter's memory by the running program or by a TSR as ASCII codes. On a graphics screen, however, the video adapter's memory contains bit patterns that appear as characters to our eyes but that are meaningless in ASCII terms.

Granted, the ASCII representation is in there somewhere, but finding it and synchronizing it with the screen displays is a major problem. We can only encourage Microsoft to put the necessary hooks into Presentation Manager and *Windows*, Version



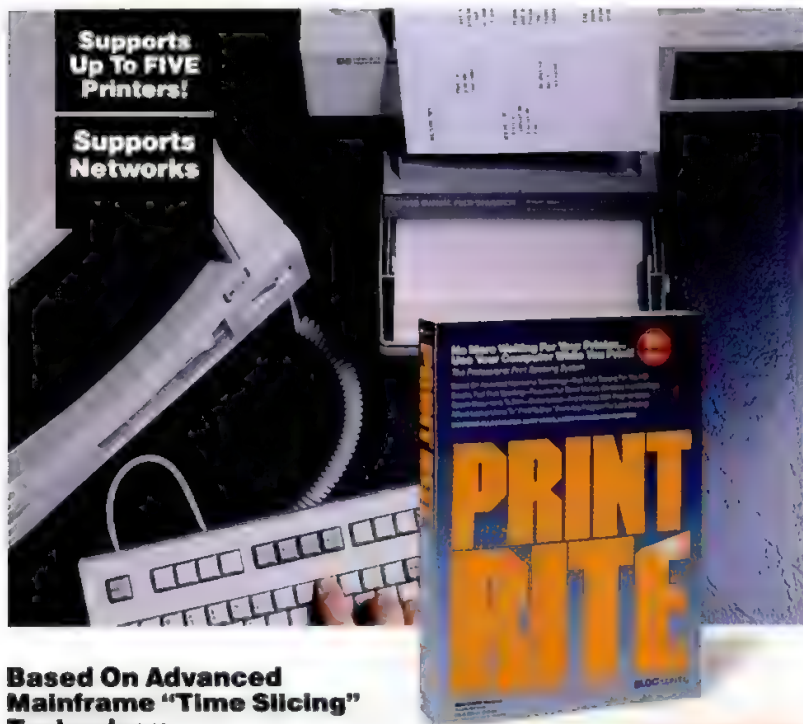
ILLUSTRATION: STEVEN JOHNSON

3, to make screen-reading drivers easy to program and device-independent.

Robotics is another important assistive technology, but it tends to be expensive. Zenith Data Systems and PRAB Command together offer a tour de force system for quadriplegics. Built around a Zenith 386 PC, it comes with a voice recognition board and a controller for the PRAB robotic arm, and it runs standard DOS applications. When combined with a laser printer,

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Bill Machrone

this system can make a paralyzed worker as productive as anyone else in the office. The arm can load and unload the printer and perform various other utility functions, all under voice control. The system dials and answers the phone and can also perform a variety of personal services, such as fetching a tissue or a drink of water from a predetermined location—critical for helping handicapped employees build the requisite sense of independence.

STICKER SHOCK

The Zenith/PRAB system goes for about \$50,000, but before you let the price floor you, think about the cumulative cost of maintaining a quadriplegic for life on welfare and disability insurance. The mere fact that it lets a disabled person work productively should be enough to justify it. Sadly, many disabled and handicapped workers, even those who can make use of assistive technologies, do little better than break even. When they work, they lose benefits such as social security, and between the costs of special transportation, equipment, and unreimbursed medical expenses, it's hard for them to make ends meet. That's why the equal access law for federal employees is so important. It lets the handicapped worker start with an equation that's closer to balancing. We can only hope that private business follows suit.

Like OCR software and scanners, other mainstream products can be adapted for use by the handicapped. For instance, SkiSoft's *Eye Relief* word processor is nominally intended to be more readable on laptop screens. It lets you display large fonts on-screen, including a jumbo font with only 16 characters per line. Happily, *Eye Relief* works on desktop machines with graphics boards, too, making it possible for a visually impaired worker to use a display that is readable across the office or even down the hall by people with normal vision.

Human nature being what it is, some people may perceive special accommodations for handicapped workers as preferential treatment. It takes an open mind and a fair amount of training and orientation to make a mixed environment work. A handicapped friend once branded the rest of us as *normies*. Let's hope that's not a prejudicial term. ■

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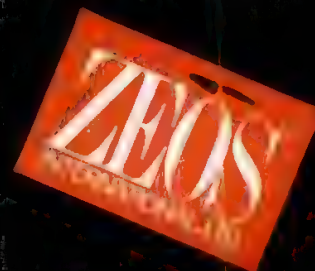
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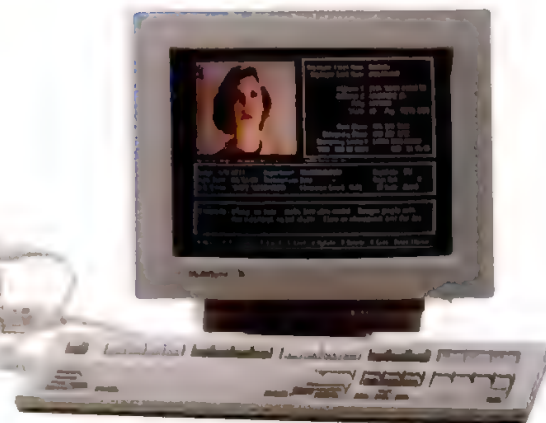
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John C. Dvorak



Microsoft has always made a pretty good living on its marketing ability. Now it's time for it to start playing in the big leagues.

As Microsoft heads toward billions of dollars in sales, what are we to make of it? Is it good that Microsoft is so dominant in such a new industry? Will Microsoft always be dominant? What is Microsoft's contribution to the industry? Is Microsoft leading the industry around by the nose and exploiting it, or is it merely doing a good job at what it does? And, finally, what's next for Bill Gates?

Let's start out with an assumption. Microsoft is a marketing company, period. In fact, it's one of the best marketing companies I've ever seen. Hordes of telemarketers are always on the phone pushing products. Gates is always on the road promoting the company. Ad agencies are busy hyping its image. PR firms are grinding out gimmicky publicity stunts (I even have a bar of *Microsoft Word* soap). These guys know how to sell.

Now, if I may be so bold, this notion of mine that Microsoft is a marketing company (period) is exactly why it should buy the New York Yankees.

This is not a joke. Hear me out. The old New York Yankees never went a decade without winning at least one World Series, and many times they won three or four. In all those long years, the team was always a contender. That is, until the 1980s, during which the team's owner, George Steinbrenner, has decided to let the team deteriorate while he collects lucrative cable TV royalties. New Yorkers hate the guy.

Back to Microsoft. Microsoft is a modern marketing company and surely knows the value of free publicity. Companies like Apple and IBM have sponsored money-losing race cars and put up signs in ballparks all around the country. This is nothing but money wasted. An ad in *PC Magazine* is surely money better spent, especially one placed strategically next to John Dvorak's column (hint).

But imagine this. If you can manage to put up a sign in Yankee Stadium—a big Microsoft sign—and get paid to do it, then that's a smart move. A professional sports franchise makes money if it is managed correctly. Steinbrenner even makes a fortune mismanaging the Yankees. If a smart software company, a marketing-oriented company like Microsoft, were to buy

the Yankees, the team would be both a cash cow and a public relations coup. Microsoft would bury the competition.

A BOLD MOVE

Let's face it, as much as Bill Gates projects the image of the ultra-techie, his real gift is that of the entrepreneur. He makes Donald Trump look dopey. His ambitions go way back. When he was a kid in school, Gates cornered the market on McGovern-Eagleton campaign buttons and made a killing. His passport says "Programmer" under occupation. Hah! A mere ploy. He's a businessman deep down inside, not a programmer. Right now, concentrating on Microsoft is the most profitable thing he can do with his time. Toying with IBM and Intel has made him a billionaire.

In many ways, Microsoft runs itself, with Jon Shirley there to keep things on an even keel. But things will soon flatten out or even decline if the company fails to execute some

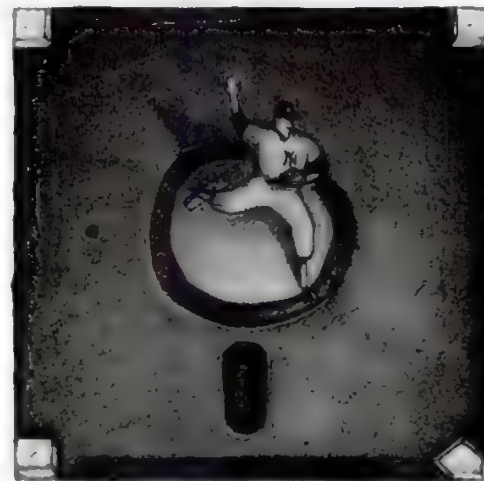
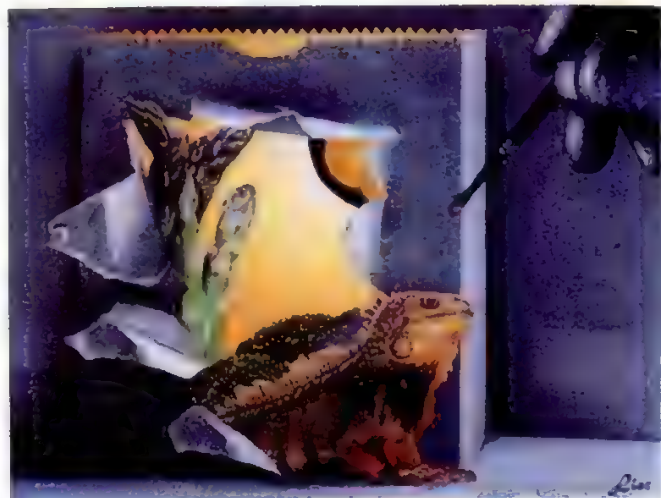


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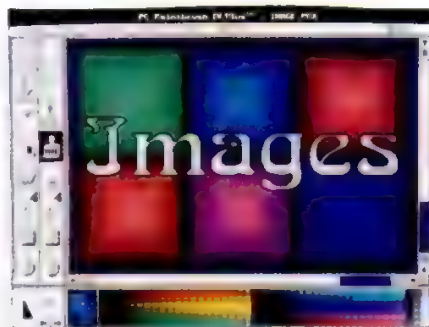
bold new maneuvers. As I suggested in a previous column, if a megasoft company with the merged talents of, say, DRI, Ashton-Tate, and WordPerfect came along, Microsoft would have its hands full.

But if Microsoft were to buy the Yankees, its brand-name would be forever fixed in the minds of all America, and even of most of the world. The company would be way out in front. Do it, Bill.

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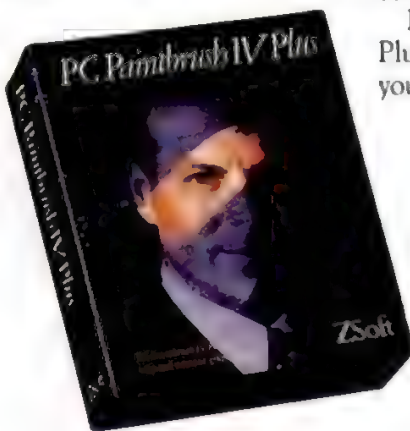
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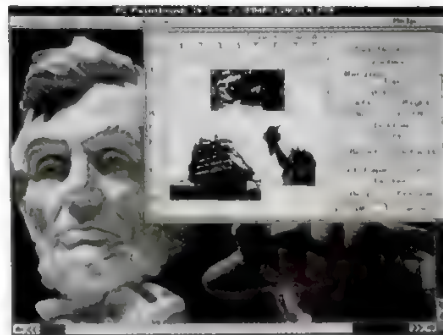
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CIRCLE 744 ON READER SERVICE CARD

Inside Track

Where can we expect the coders of tomorrow to come from? Don't be surprised if the **Soviet Union** starts selling

code. If you haven't noticed, there's a flurry of activity insofar as the Soviet Union and high tech are concerned. Industry pioneer Lee Felsenstein has been trucking back and forth trying to set up a network there. Even pundit and newsletter publisher Esther Dyson is zooming in and out of Moscow looking to **make a killing**.

The perception is that there's gold in them thar hills, a perception that is actively promoted by the Russians themselves. I have to wonder what they must think, watching the **drooling capitalists** pant over nothing more than "potential."

I was fortunate enough to be invited as an observer to an Autodesk CAD show in Moscow, where the company cajoled dozens of Autodesk third-party developers (mostly from Eastern Europe) to join in an **amazingly large trade event** showing off products to the Russians. The idea was to get the Soviet Union, which has a disproportionate number of **computer-starved mathematicians**, to wake up to the future and join the computer revolution.

The fear among political conservatives, of course, is that the only revolution the Russians want to join is the one that will "bury" the West. In fact, one visit to Moscow, perhaps the most **depressing place** I've ever been, indicates that Khrushchev's famous boast "we will bury you" may be true. With the standard of living falling so rapidly there, it's possible that any given Russian in a free-market economy may be qualified to work only as a minimum-wage **grave digger**. Their socialistic system has produced a **pitiful specimen** of the "I-don't-have-to-do-anything-you-can't-fire-me-it's-not-my-problem" worker.

Things have to change, but nobody knows what to do to change them. All they know is that they need computers to maximize the work of what few people actually do any work. The Soviets want a **million and a half machines** right away, and they are willing to pay a bundle for them. Soviet officials talk out loud about how much a stock PC-XT hand-carried to the USSR sells for on the black market (out of **dubious** "second-hand" stores)—about 40,000 rubles. Given that the ruble is officially set at about 65 cents, you can see why eyes light up. **The joke** is that a ruble is worth far less than 65 cents and in fact can easily be **exchanged illegally** on the street for 6 cents or even less.

While I was in Moscow, the government created a "special" conversion rate that reflects the black-market price to minimize such activity. Apparently it doesn't reflect com-

mercial transactions, which are still converted at 65 cents or so. Whatever the case, none of this does the international traders any

good, since rubles **cannot be exported** nor do they have any value internationally. You also can't exchange them for more dollars than you brought with you. So you can sell an XT for \$26,000 or more worth of rubles, and all you'll get in the end is a bunch of rubles. You may also find yourself dead, since the average Russian makes 200 to 300 rubles a month. Entire families have been **killed in their homes** in computer-related

thefts. The Soviets refuse to float the ruble, probably more out of pride than anything else. The system **hates criticism** or humiliation, and a ruble worth pennies would be an insult, even if it is worth only pennies. So those wanting to do business with the Soviets have to trade for something if they want to get something valuable out of Russia. **Richard Handyside**, the amazingly talented director of England's Autodesk (who somehow managed to arrange the successful trade show in a country where advertising is verboten), says that one company wanted to **trade software for yurts—Mongolian tents!** The recent flood of Russian vodka stems from many of these deals.

Autodesk discovered one formula that may help. It created a joint venture with some Soviet programmers and a science agency to form Parallel. Parallel has developed a **LISP compiler** so complex that it was supposed to be impossible to do, and it receives hard-currency fees for selling this compiler in the West. The hard currency is extracted by Autodesk in exchange for rubles through a **slick bookkeeping maneuver**.

It turns out that the Russians may actually be able to save their country from ruination or a return to deadly Stalinism by selling their programming skills to the West. Gold fever is again triggered when you consider the possibility that professor-level programmers may be had for the fees afforded a **Mexican day worker** south of the border. For the sake of hard currency the Russians say that they absolutely, positively want to be exploited in this way, **capitalist pigs** that we are in the West. So everyone who knows about the situation is jockeying for position, figuring there may be a bonanza here. **Microsoft, CompuAdd, Ashton-Tate, and Lotus** were all mentioned by officials as working on these so-called high-technology joint ventures.

So you can expect to hear more about these deals in the future. But the smart comment is: "Yeah, but what happens to these deals if Gorbachev fails?" As one joint-venturer said to me, "Right now there is a lot of false optimism. In fact, this is nothing more than a giant **house of mirrors**." ■

Everyone from
Microsoft to Esther
Dyson thinks the
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Jim Seymour



Today's local area networks are still too complex for any human being to handle. If network vendors don't face up to this problem, they risk torpedoing their emerging industry.

What's the worst job in America?

In a story a few years ago, the editors of *Texas Monthly* concluded it was the strange occupation of chicken sexer—a person at a poultry farm who determines the gender of newborn chicks. I'll spare you the gory details, but basically the work involves rapid, close-up examination of the wrong ends of largely incontinent baby chicks. Followed by a heart-rending division of the house into egg-layers, fryers, and soon-to-become-animal-feed.

But I have a better candidate: LAN Administrator.

Because whatever the job title, the people responsible for keeping American business's local area networks up and running have one of the worst jobs I know.

When I said as much at a recent *PC Magazine* industry forum, the audience roared back its agreement: it's a lousy job, and they knew it—although many of them contribute to making it that way.

At first, becoming a LAN manager looked pretty good. A lot of former micro managers, bored with ordering software upgrades and frustrated with telling users *no* when they asked for 386s, were eager to segue into the new job administering the local area network.

Though still a part of the MIS/info center/PC support group continuum, the LAN manager's job looked like a promotion. Once again, these people would be on the leading edge; once again, they'd be in a highly visible job; once again, they'd be noticed and rewarded for their initiative and ingenuity.

Well, they got noticed. And if you consider living by your wits twenty-four hours a day the applied use of ingenuity, they scored on that account, too.

LAN managers have turned out to be lightning rods for corporate PC management: whatever goes wrong, blame them. And the bigger the problem, the likelier that is to be the reaction.

As businesses move away from reliance on minis and mainframes toward networked PCs (including wide-area networks connected through network gateways), the more important those networks become to the smooth functioning of the business. And the more vulnerable network managers become to the drawbacks of the poor

tools the PC network business currently provides.

On one level, those tools are getting better. Such systems as Network General's Sniffer are indispensable distant-early-warning tools, alerting the network manager to incoming missiles. Those boxes are priceless diagnostic tools for untangling what went wrong, simulating network loads, and watching for what breaks, when, and why.

BACK TO BASICS

The real problem lies on a much more fundamental level: networks themselves are still far too complicated to install and manage. This is a problem LAN vendors have got to fix. And fast, lest we see a stall-out in the explosive growth of the networking market.

Bringing up a new network is tough enough. But managing it on a daily basis—adding and deleting users, maintaining passwords and other security measures, adding new programs, updating existing network software, and adding

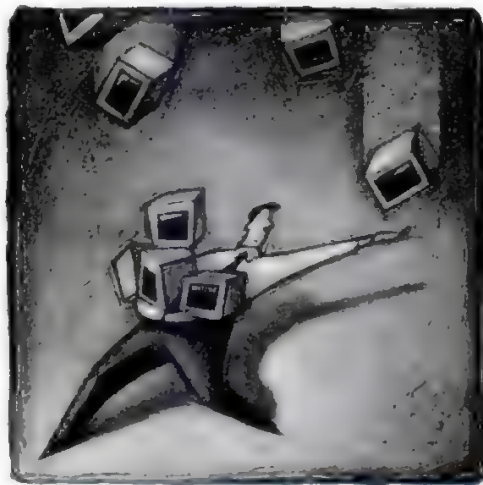


ILLUSTRATION: STEVEN JOHNSON

file servers and print servers—is simply beyond the ability of many of the people who are responsible for running corporate LANs.

Because they're inept? Hardly.

One of the most technically savvy network administrators I know told me recently that he "lives right on the edge—on the edge of what I know, on the edge of this whole thing going down. I'm faking it half the time, and the odds are catching up with me."

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CIRCLE 362 ON READER SERVICE CARD

Jim Seymour

He said he gets lousy support from Novell, the vendor that supplies the software that runs the networks he manages. I've heard the same complaint from managers of networks from 3Com, Banyan, and other vendors. Novell's not alone in tossing customers in over their heads.

Network vendors, listen closely: no matter what the current sales figures say, it cannot be a happy moment for your industry, nor a happy sign for the future of that industry, that the great majority of your customers feel overwhelmed, massively undersupported, and vulnerable . . . and are running scared.

My colleague and workgroup systems specialist Frank Derfler has suggested that somebody out there is going to make a great deal of money by setting up a national, third-party support organization solely for LANs and LAN administrators. Amen, brother.

Some firms are already starting to do this; Pritronix, for example. Some offer products and services on a cafeteria-line basis, from a few network cards to a full turnkey installation, from fix-it-when-it's-broke service calls to preventive maintenance and even to training the customer's own staff.

But the problem starts—and it must end—with the network vendors. No matter how loudly we scream for more performance, more support for new computing platforms, and the rest of it (the kinds of performance-oriented demands that currently claim virtually all of the research and development attention of the big network vendors), more attention must be given to improving the ease of installing and especially the ease of *managing* PC LANs.

Or this house of cards is going to start tumbling down.

THE MOMENT OF TRUTH

That savvy network administrator who told me of his despair said he's ready to walk. "I'm tired of always being the fall guy. I want to sleep again at night. It may look like I have job security—they think I'm the only one who knows how to keep the networks up—but it's really job *in*security, because that's not true any more: I *don't* know enough. No one does. I'm thinking of getting out."

It's enough to make chicken-sexing look good. ■

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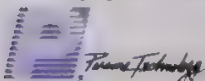
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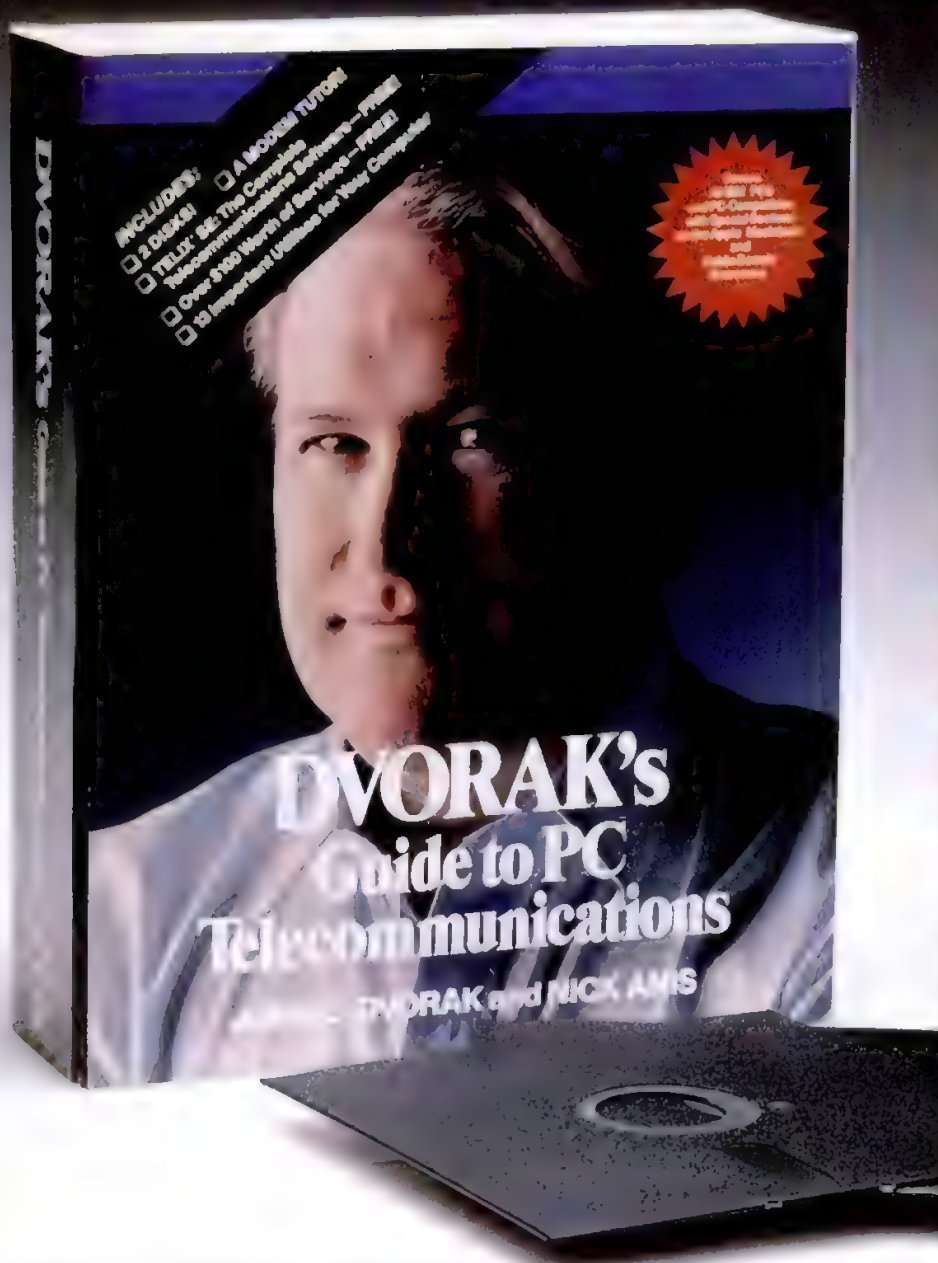
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William F. Zachmann



**After three years
and untold amounts
of speculation,
it seems clear that
Micro Channel
is IBM's standard.
And nobody else's.**

When IBM's Micro Channel architecture was first announced along with OS/2 and the PS/2 line in April of 1987, many assumed that it would define a new standard for the industry. After all, hadn't the IBM PC and XT with their 8-bit buses and then the AT with its 16-bit bus done just that? Wasn't it reasonable to assume that history would repeat itself?

Although some determined souls still vigorously assert that Micro Channel will become the definitive standard, most people have noticed that something different is happening. Continued strong sales of AT-bus (now commonly called Industry Standard Architecture or ISA) systems and the emergence of powerful new EISA (Extended Industry Standard Architecture) systems offer little support for such claims.

IBM certainly has sold and continues to sell lots of Micro Channel systems. But, ominously, only a handful of other vendors have introduced Micro Channel clones, and their sales have been thoroughly underwhelming so far. Micro Channel is beginning to look much more like a semiproprietary IBM deviation than a dominant industry standard.

At the same time, EISA—which Micro Channel zealots claimed was merely a negotiating ploy to get IBM to lower Micro Channel licensing demands—is emerging as a widely supported standard, with dozens or even hundreds of system and board vendors signing up to make products for it. EISA isn't likely to overtake Micro Channel in the short run (although that's certainly a good possibility in true 32-bit implementations). But there's no doubt that sales of EISA machines will easily surpass the sales of Micro Channel clones in the months and years ahead.

What is different this time? Why has Micro Channel remained largely confined to IBM systems while the rest of the world has gone merrily on its own way?

The technical aspects of the competing alternatives are only a small part of the big picture. In its 16-bit implementation, Micro Channel systems offer no significant performance advantage over ISA systems. IBM's 286-based PS/2 Models 50 and 60 are no more than average performers, and even IBM's 386-based PS/2 Models 70 and 80 offer no better

performance than comparable 386-based ISA systems. While Micro Channel's automatic configuration capabilities are certainly a plus for some users, the inconvenience of not being able to use existing ISA cards in Micro Channel systems is certainly a minus for others.

THE PROOF IS IN THE EATING

Similarly, the real distinction between Micro Channel and EISA systems isn't technical. Both bus specifications have theoretical capabilities that go well beyond anything actually being used to deliver real value to users at this point. And both have enough headroom to be more than adequate for a long time. The important difference is in the performance and function of the systems offered by vendors, which are determined not by which bus is used, but by how well each system is designed and built.

Partisans of both camps will argue these points, but the bottom line is that nearly three years after its introduction, the supposed technical



ILLUSTRATION: STEVEN JOHNSON

advantages of Micro Channel have yet to be demonstrated as real benefits to users. Thus, the explanation of why Micro Channel has not become an undisputed industry standard must be found elsewhere.

First, Micro Channel isn't a standard, quite simply, because IBM didn't want it to be. From the very beginning, IBM intended Micro Channel to eliminate competition from vendors of compatible systems. As early as April 1987,

William F. Zachmann

IBM made it perfectly clear that its definition of open architecture meant only that third parties could write software to run on the system or build boards to work in the system. It most definitely did *not* mean that third parties could build compatible systems to compete with IBM's.

Only after many months of steadily eroding market share did IBM grudgingly offer to license the Micro Channel patents to other vendors. Even then, the initial terms were so stiff that many vendors found them unacceptable. And the presence of bus lines "reserved for future use" in the original specification made it obvious that IBM planned future versions of Micro Channel.

Third-party vendors planning Micro

Channel clones knew that they were likely to find themselves in an ongoing game of catch-up, as IBM introduced enhanced versions of the Micro Channel bus. Further, simply licensing the Micro Channel patents did not guarantee that they could build truly compatible Micro Channel systems capable of running future versions of IBM's OS/2 Extended Edition. Yet users would be unlikely to purchase clones without the assurance of such compatibility.

Which brings us to the most important reason why a lively Micro Channel clone market has not developed. Users have bought Micro Channel mainly because that's what IBM offers. That is, users don't first decide they want Micro Channel and then buy an IBM machine; they decide to buy an IBM and thus buy Micro Channel by default.

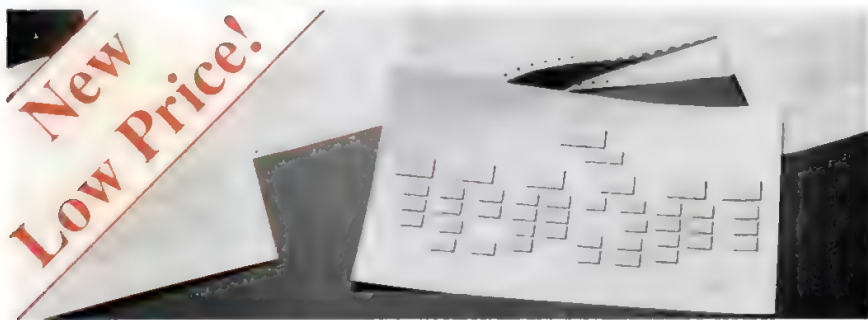
Buyers who think they are better off buying Micro Channel already think they're better off buying IBM, and they aren't likely to settle for a clone from somebody else. And buyers prepared to consider purchasing PCs from other vendors already know that they can get better performance at lower prices than PS/2 systems offer. They know better than to believe IBM's "country road and superhighway" stuff in the first place.

MOST EVERYONE WINS

All of which adds up to lots of good reasons for most vendors to continue making ISA systems—and to make EISA their primary choice for more-capable 32-bit systems in the future. This strategy will let them avoid playing IBM's game by IBM's rules. It lets them concentrate on delivering the most value to users, instead of wasting their resources tagging along after IBM.

Users are the real winners, as usual, when there's intense competition among vendors. The impressive rollout of EISA products over the past few months has stimulated IBM to make greater efforts to bring products that take advantage of Micro Channel from the vapor zone into the reality zone. We now have our choice of a wide and growing range of ISA, EISA, and Micro Channel systems to meet our various needs.

At the same time, Micro Channel clones are looking more and more like an idea that simply never saw its day. They are likely to remain an insignificant element in personal computer sales, as Micro Channel becomes merely the IBM alternative and EISA becomes the standard for everyone else.



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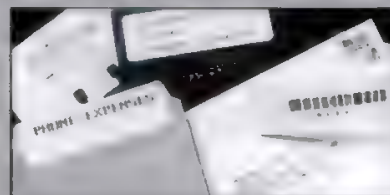
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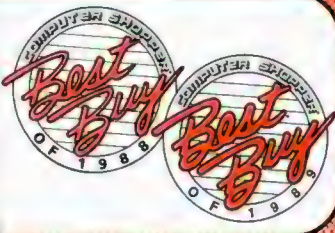
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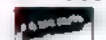
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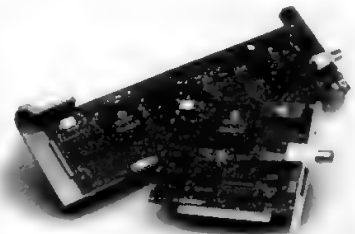
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Midwinter. Skies are gray. To pass the time until the grapefruit league begins, America discusses computer-industry standards. At supermarkets throughout the country, the hottest waiting-to-check-out topic is EISA versus Micro Channel. Over at the quick-lube emporium, you hear nothing but MNP Level 5 versus V.42bis. And down at the post office, lines of waiting customers engage in endless font-filled disputation over Royal and PostScript.

But many of this industry's greatest and best-known standards, refined through years of successive iteration, have never gained official recognition. You recognize them instantly when you see them, yet these ubiquitous archetypes have had neither guidelines nor names—that is, until now.

Over the past year, the newly formed CCILPV (*Comité Consultatif International de Logiciel et Progiciel avec Vins*), dedicated to the careful consideration of worldwide standards in a relaxed bistro setting, has begun codifying the standards that have so far slipped through the cracks. In secret sessions at Versailles, convened beneath the classic French coat of arms (whose motto translates to something about eating cake), members of the organization's various subcommittees have been working diligently to create a body of new standards that conform to recognized industry practices. The goal is to unite America, Europe, and the rest of the globe in time for the opening of the European Common Market in 1992—with the help of protocols such as these:

BAR (Binder Assembly Required) 2.2. Propounds an ironclad rule that no three-ring-bound manual may come preassembled with dividers in place; offers additional recommendations to make the otherwise boring binder-assembly process more challenging and fun for users.

SBF (Spiral Binding Formula) 15. Prescribes that all spiral-bound manuals must appear absolutely identical when shelved spine out.

IO (Index Omission) CP7-7. Bipartite standard recommends unindexed manuals and also suggests means of rendering indexes useless where inadvertently supplied.

CP (Chapter Pagination) 4-56-7.7. Demands that manuals be paginated within individual chapters rather than throughout the book to

maintain ease of production and updating rather than ease of use.

NQS (No Quick Start) X.0. Mandates that setup instructions be included in a weighty reference volume rather than a slim, pithy quick-start manual.

MIS (Mandatory Installation System) 0.1. Stipulates that program installation must always take place from drive A:.

SOFA (Standardized Off-standard Format Availability) 1. A multipart protocol requiring vendors to offer products in formats other than the ones users are actually likely to own. SOFA 1.1, for example, ensures diskette/drive mismatch; SOFA 1.2 works similarly for jacks and connectors. Other standards are reportedly in the works.

UPS (Upgrade Path Stymlie) 6.7. Prescribes numerous means of making software and hardware upgrades inaccessible to the vast majority of current users by requiring additional memory, additional hardware devices, costly special adapters, and so on.



ILLUSTRATION: STEVEN JOHNSON

UNDOC (Uniform Need for Documentation) 0.2. Ensures that no salient operational information (such as jumper settings, basic help, and so on) or identification (such as function of cable) will appear anywhere on a product, thus requiring consultation of a manual that is certain to be unavailable when necessary.

NCI (Non-Conforming Interface) F13. Demands that at least one function in any new software

Stephen Manes

or hardware product work in a substantially different way from all predecessors.

MDL (Minimum Difficulty Level) 99.9. Originally developed for recreational software, this generic software standard ensures that mastery of even the lowest level will require more time than any fully employed adult has available.

FFC (File Format Change) Level 6. Requires that each new software upgrade employ a new file format utterly incompatible with all previous releases, as well as with all third-party add-on programs.

TSRPC (TSR Program Conflict), Parts E and O. Part E, for TSR programs, ensures noncompliance with standalone software because of interrupt conflicts, excessive memory demands, or other incompatibilities. The similar Part O, for standalone software, ensures noncompliance with TSRs.

2BIG (Excessive Memory Utilization) 4U. Requires that device drivers and RAM-resident programs (including network software, described in Subpart Z) occupy sufficient memory that popular standalone

programs won't quite run—or, optionally, will run, but without room for data.

VAR (Value Addition Required) 7/70. Ensures that network systems require consultants for successful operation.

OS2U (OS/2 Upgrade) 1.3. Guarantees that IBM versions of OS/2 will not work in their entirety on other computers. Further guarantees that non-IBM versions will arrive a minimum of six months after the originals.

GAS (Graphics Adapter Standard).PC. Ensures that no VGA card (including IBM's) will adhere properly to IBM VGA documentation or run the entire suite of PC Labs benchmark tests.

CDXA (CD-ROM Extension Anomalies). Prescribes that CD-ROM programs conflict with certain other software and fail to operate under such "advanced" operating systems as OS/2.

EEMS (Extended-Expanded Memory Stupefaction) 5.0. Guarantees utter confusion in all attempts to describe extended and expanded memory functions.

NLS (Nationwide Local Support) 6.7. Offers vendor guidelines for maintaining total independence from user complaints via a policy of offering support only through

dealers who have no idea how to diagnose or fix problems.

SCP (Support Call Protocol) 15.6. Sets standards for the minimum number of rings, minutes kept on hold, and unavailability of trained help, as well as consistency and lameness of excuses.

UR (Unnecessary Registration) 7.9. Strictly limits the use of registration-card information to promotional purposes only; prohibits its use for bug fixes or free upgrade notifications.

PDR (Printer Driver Responsibility) 0.0. Fixes responsibility for the development of any necessary printer drivers for any purpose whatsoever squarely on the user.

NDP (Network Downtime Procedure) 3.1. Offers recommendations for determining how users of a given network installation should pretend to perform their duties during system outages.

U (Standards Development Nomenclature) 3.77bis Level 5.3. Stipulates that future CCILPV nomenclature is to follow the traditional international-standards policy of incomprehensibility and arbitrariness (as in V.22bis, X.400, and U2), thereby requiring most new CCILPV standards to be renamed next year. ■

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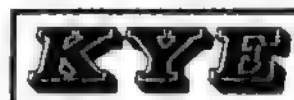
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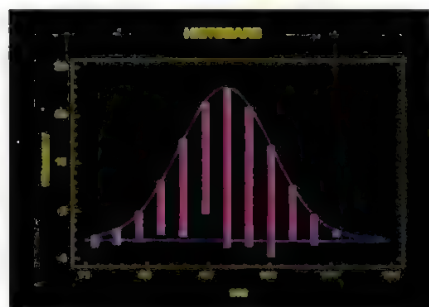
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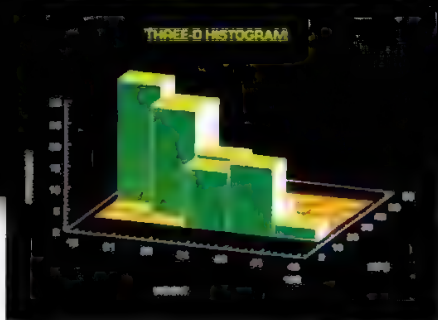


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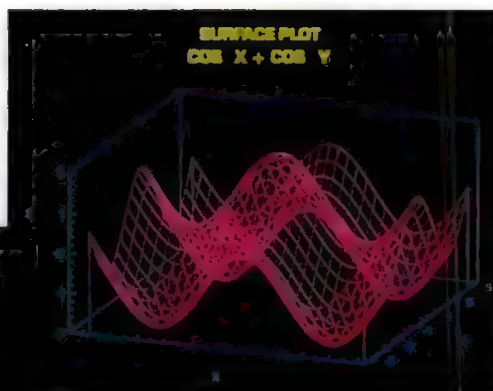
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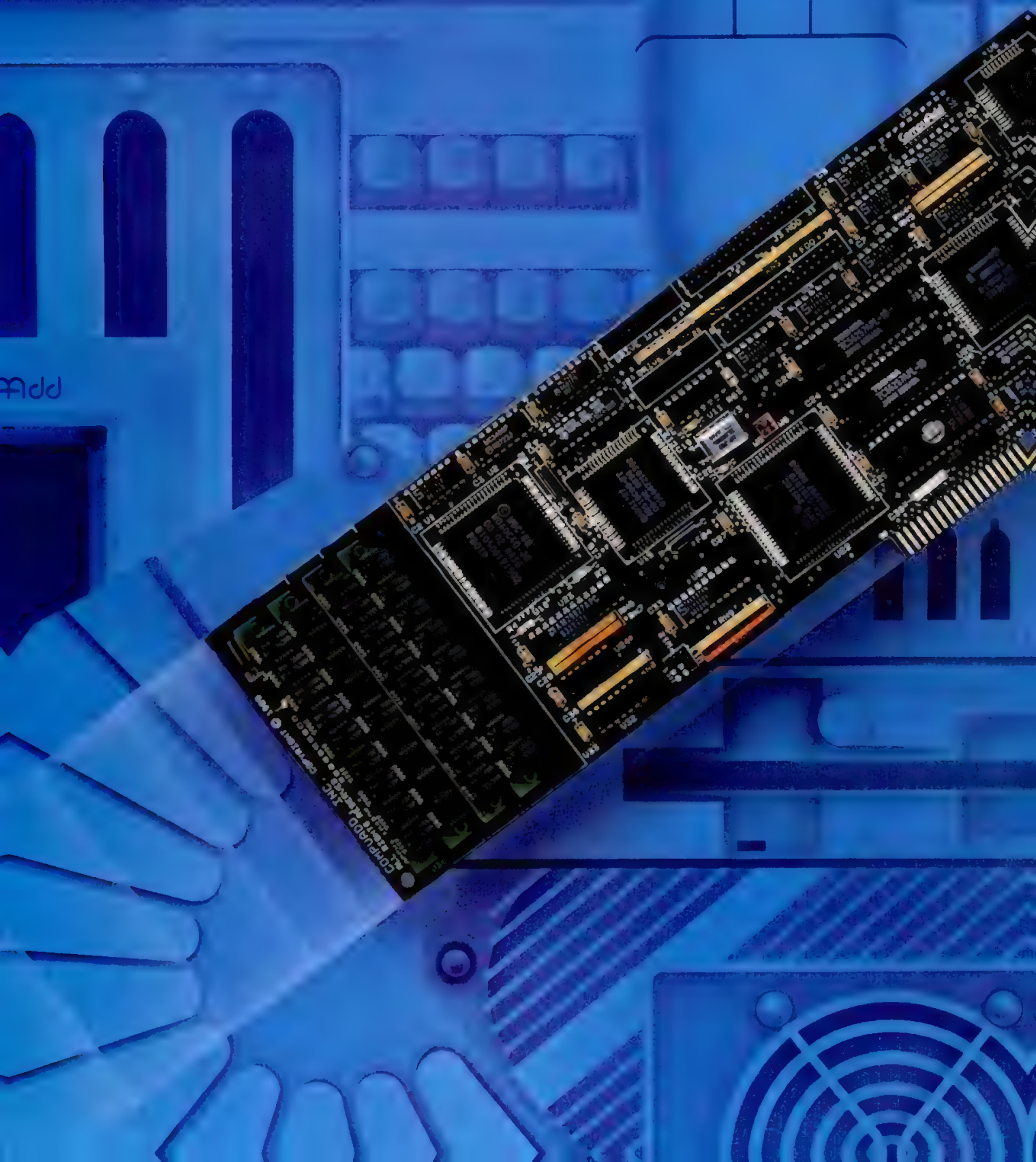
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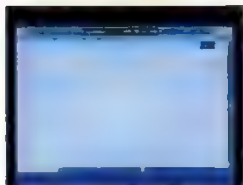
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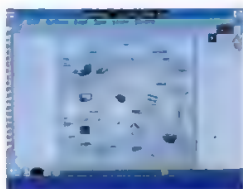


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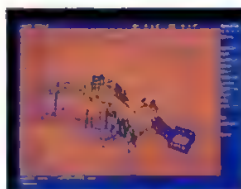


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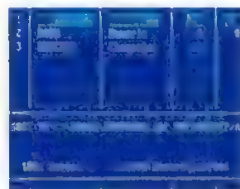


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Energy Production
1980-1985
Bar chart showing production levels for various energy sources.

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than 286-based machines
for just a few hundred
dollars more.**

The friendly looking, shirt-sleeved executive peers out at you over his half-height reading glasses and asks, "Why should I buy a 386 computer?" That's an important question today, so important that this scene appears on the cover of an unusual document—a marketing brochure published by Intel Corp.

It's not so unusual that the world's largest microprocessor maker has published a marketing brochure. What is unusual is that this brochure is not aimed at Intel's traditional customers: PC manufacturers that buy processor and memory chips, power supplies, resistors, and wire. It's aimed at you. Intel has decided to enter the corpo-



PHOTOGRAPHY: THOM O'CONNOR

rate marketing game and sell its processor technology directly to users and buyers of the PCs made by its direct customers.

Intel wants you to do more than just buy Intel-based PCs. It wants you to buy PCs featuring Intel's own 386 processor, and none other. This move is the latest from Intel in its nearly four-year-old quest to move the PC industry away from less-powerful, less-capable 80286 and 8086 processors (markets that Intel does not monopolize) and stand the industry firmly on a foundation of 80386 processors.

Marketing directly to users would be an unusual move for any other player in the chip business. But it hasn't been unusual for Intel to try to convince you and the PC industry to think in terms of 386-based PCs. It's just that Intel's earlier moves looked more like technical achievements than marketing gestures.

Part of Intel's current marketing strategy centers on the company's new 80486 chip. That incredible piece of silicon contains an improved 80386, a high-performance version of the 80387 coprocessor, an 8K static RAM cache, and a sophisticated cache controller to operate it. The chip is so compatible with the 386 that Intel is positioning it as just that, an 80386 microprocessor, albeit one with a more upscale clientele than an ordinary 386.

You should be even more familiar with the 80386SX, another of Intel's nudges in the 386 direction. Introduced in July 1988, the 386SX is closer to the 486 than you might think. Internally, the 386SX processor works exactly like any other 386 or 486. It can perform instructions and all of the 386's multitasking and virtual memory tricks, including operating in the 386's virtual 8086 mode in which multiple 8086 software, such as DOS, can run simultaneously. In short, the SX processor runs *all* the software and operating systems that the 386 and 486 run, for less money.

ATTENTION 286 SHOPPERS

Intel wants every potential PC buyer who is thinking about buying an 80286-based PC to think again and buy a 386SX-based computer instead. The 386SX's hybrid 16/32-bit design makes it the natural successor to the 286 in a 386-based PC marketplace. At the same time, its 16-bit input-output design allows PC makers to use

For the features section of this issue, the associate editor was Donald P. Willmott and the PC Labs project leader was Pamela J. Milland.

less-expensive components and a PC architecture very similar to the one used for AT-class 80286-based PCs. The SX runs 20 to 25 percent faster than a 12-MHz 286 on the PC Labs Instruction Mix benchmark tests, while it costs only \$200 to \$500 more.

Intel and its PC-manufacturing customers have had little trouble convincing users—especially in America—to invest in 386-based PCs. As prices have come down since the first 386s were introduced in 1986, more and more PCs have been 386-powered. When *PC Magazine* pro-

SX

**There just isn't a better
chip on the market than
the 386, and the 386SX is the
lowest-cost model
available, perfect for
entry-level users in
today's corporate market.**

SX

duced the 386-only issue less than a year ago ("80386: The Power and the Glory," May 30, 1989), 104 386-based PCs were reviewed. Today, there are easily twice as many available, especially with the introduction of the 33-MHz 386.

The 386SX has not been as easy to sell as the 486 has. At the time of the 386-only issue of *PC Magazine*, we could find only five 386SX-based PCs actually in production ("The 80386SX Gets a Jump Start," May 30, 1989). That was six months after the SX chip was introduced; vendors were staying away from it in droves. Much of the SX malaise was a result of Intel's pricing of the processor. When it was introduced, the chip cost \$189 in lots of 1,000 pieces, roughly four times the cost of Intel's 80286 at the time. Ancillary components, such as the "glue" chips required to put a 386SX-based PC together, were also expensive.

There were other factors that damaged the new chip's potential success. A major one was Compaq's pricing of the Deskpro 386S, the first 386SX-based PC on the

market. A complete VGA system cost about \$5,900. While this was only about \$400 more than a 12-MHz Deskpro 286 at the time, the 386S was still far more expensive than many full-scale 386 machines from other vendors, causing many 386 buyers to look elsewhere.

FLASH IN THE PAN

Competition from the high-performance 80286 chips built by Harris Corp. and AMD also frustrated the initial success of the 386SX. Running at speeds of 16 MHz and 20 MHz, these chips formed the basis of a breed of souped-up 286-based PCs that delivered astonishing performance at attractive prices. Companies such as Dell Computer Corp., Northgate Computer Systems, and Zeos International sold truckloads of the machines, but only for a short period of time.

It turned out that the fast 286s were a flash in the pan. Intel wisely slashed the price of the SX by more than half, and today the chip sells for \$89 in lots of 1,000 pieces. The result of this price drop is evident when you compare the 14 386SX-based PCs available when *PC Magazine* last reviewed them ("Out in Force: 14 Machines with the SX Promise," August 1989) with the 31 new SXs for you to examine here. That makes a total of about 45 on the market with more coming out almost every day, such as the Hyundai Super-386S, which just missed our testing deadline. Other companies that have SX machines not reviewed here include CompuAdd, Dell, LANtek, Micro 1, Samsung, and Unisys. Dataquest, a market research organization, reports that 21 percent of the PCs sold this year are 386 and 386SX-based machines and that one out of every 14 PCs now sold is an SX, and that figure continues to grow.

The Intel brochure is right. You should buy a 386, not for Intel, but for computing performance. There just isn't a better chip on the market than the 386, and the 386SX is the lowest-cost model available, perfect for entry-level computer users in today's corporate market. And, by the way, Intel has another brochure to tell you why the SX is such a good entry-level machine.

The 31 SX-based PCs tested here are a good example. Equipped with at least 1MB of memory, 40MB hard disks, VGA cards and monitors, they're moderately priced, ranging from \$1,995 for Intelligent Data Systems' PC-386SX-40 up to \$5,195 for a Mitsubishi MP386s with 2MB. Most of the mail-order machines, such as those

from Austin Computer Systems, Gateway 2000, and Zeos, cost about \$2,200, while the dealer-discounted Acer America Corp., AST Research, AT&T Computer Systems, IBM, NEC Information Systems, and Tandy Corp. machines range from \$3,200 to \$5,000 before any discounts kick in.

These 16-MHz SXs don't offer the head-snapping performance of a 33-MHz 386 or a 486, but they're no slugs. And besides that, they'll run *DESQview 386*, *Microsoft Windows/386*, *Paradox 386*, or any other 386 product you'd care to try. With good performance.

Try one, you'll like it.

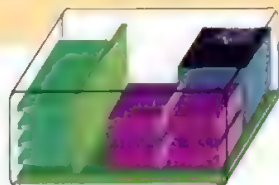
REVIEW CRITERIA

Manufacturers who participated in this evaluation sent *PC Magazine* a production-quality 386SX with at least 1MB RAM, a 40MB hard disk, VGA adapter and color monitor, and DOS by early fall 1989 to meet our testing deadline. This configuration is adequate for network users, but standalone users should consider a hard disk of at least 60MB. *PC Magazine* accepted both FCC Class A and Class B machines for review, but we recommend that you concentrate on the more stringently rated Class B machines. Because of the number of reviews that follow, the PCs are listed alphabetically by company name in both the reviews that follow and on the features table, rather than in the more customary ascending price order.

ACER AMERICA CORP.

Acer 1100/SX

by Bruce Brown



What can you learn from VARs? Acer America Corp., formerly Acer Technologies, has long sold computers favored by value-added resellers. VARs generally design, write, and sell custom or special-purpose software. Acer sells only through dealers and provides reasonably priced machines that, while not necessarily on the cutting edge, typically utilize safe designs with good performance for the dollar. Acer's long practice of providing on-site

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service via TRW for the first four months of the one-year warranty period also pleases VARs who'd rather not be bothered with the hardware problems that most often occur in the first month of a computer system's life.

Acer's SX machine, the Acer 1100/SX, has the profile typical of the company's line: good performance, a fine selection of features and components, and good expansion, at a reasonable if not headline-making price. The 1100/SX lists for \$3,265 in our standard configuration with 1MB RAM, a 43MB hard disk, 1.2MB floppy disk drive, VGA adapter and monitor, and your choice of DOS 3.3 or 4.01. In addition, *Microsoft Windows/386*, Version 2.1, and an Acer PS/2-compatible mouse are also standard.

The 1100/SX's desktop case is a slight 5.1 by 14.2 by 16.25 inches (HWD). The case front includes a power switch, reset switch, and keylock, as well as indicator lights for power-on, hard drive access, and

high-speed operating mode. The keyboard and mouse plug into ports on the front left side of the computer.

Acer makes its own motherboard, which comes with a minimum of 1MB of system memory, expandable to 8MB on the board. The 1100/SX can use either 256-kilobit or 1-megabit 100-nanosecond DRAM chips on SIMM memory modules. The system interleaves memory for best performance and also lets you selectively shadow video and system ROM BIOS independently. Acer uses an Award ROM BIOS.

None of the system expansion slots are used for interface boards; the I/O, video, and drive circuitry are all built into the motherboard. There aren't many slots, only four 16-bit, but all are free.

The system case has space for four 3.5-inch disk drives, all of which can use removable media. You can install a 5.25-inch half-height drive, but it takes up two of the 3.5-inch bays. The hard disk included with the standard system is a 43MB, 28-millisecond MiniScribe model with an IDE interface controller.

The built-in video circuitry uses a Paradise chip set and is paired with an Acer-designed 14-inch multiscanning color VGA monitor. Acer also has its own brand



Acer 1100/SX

Acer America Corp., 401 Charcot Ave., San Jose, CA 95131; (408) 922-0333.

List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, one parallel and two serial ports, utilities, *Microsoft Windows/386* 2.1, DOS 3.3, mouse, \$2,195; with 43MB hard disk, VGA monitor, \$3,265. 2MB RAM upgrade, \$375.

In Short: Acer's SX machine is a solid, small-footprint system available for a reasonable price through dealers only. Acer's one-year warranty includes on-site service through TRW for the first four months.

CIRCLE 410 ON READER SERVICE CARD

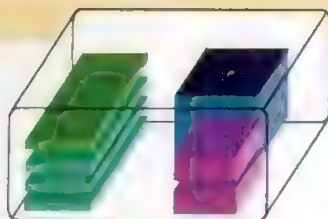
of keyboard, a typical 101-key unit that comes with a short 60-inch cable, though the cable length is not a crucial drawback since the keyboard plugs in near the front of the system.

You can spend less for a 386SX, and of course you can spend lots more than the Acer 1100/SX costs. While there's nothing particularly exciting about this machine, the combination of components for the price, along with the vendor's proven track record and support service policies, makes the Acer SX an attractive alternative. So take a tip from VARs and check out this machine.

ADVANCED DIGITAL CORP.

Powerlite 386SX

by Edward Mendelson



When you unpack Advanced Digital Corp.'s Powerlite 386SX computer, you may experience a moment of panic when you suspect that you've been sent a modem by mistake. This computer fits all of its functions into a tiny metal box that measures a mere 4 by 11.5 by 15 inches (HWD), and its price seems miniaturized also. The Model 141 tested by PC Labs, with 1MB RAM, 40MB hard disk, one 3.5-inch floppy disk drive, and caching controller, plus VGA and serial, parallel, and mouse ports, costs \$2,175.

ADC uses a passive backplane design with four 16-bit slots, two of them occupied. One slot holds the Single-Board Computer card, a densely-packed board that somehow finds room for a 386SX processor, a socket for an 80387SX, 1MB of RAM, circuitry for the I/O ports and VGA, and connectors for either a 1MB or 4MB daughtercard. On the card's mounting bracket is a PS/2-style keyboard connector, Logitech bus-mouse port, serial port, and VGA socket. The parallel port is connected to the case's back panel by a cable. In PC Labs' processor and memory benchmark tests, this one-card computer performed among the better machines, but its video results were disappointingly slow.

A second slot holds the Ten Time cach-

COMPUTERS 386SX MACHINES

ing disk controller, whose origin ADC doesn't want to mention, but which is obviously the familiar Konan model. In testing, the 128K cache on the board produced dramatically fast results on the BIOS Disk Seek test, but the cache was too small to permit improved results on the other tests. For \$200 less, ADC offers a Model 140 with a Western Digital MFM controller that supports a 1:1 interleave. This may be a better value, partly because the manual for the caching controller warns of potential software/hardware incompatibilities.

The front panel has a big reset switch and a single 3.5-inch floppy disk drive. The tiny box has room to hold only this drive and the internal 3.5-inch hard disk and nothing else. ADC offers the option of a 100MB hard disk instead of the 40MB model, but you have to add additional storage (such as tape backup) through an external unit or not at all.

Setting up the Powerlite 386SX is a matter of plugging it in and switching on the power. If you want to start customizing, you get diagnostics and setup in ROM. The manual shows beginners



Powerlite 386SX

Advanced Digital Corp., 5432 Production Dr., Huntington Beach, CA 92649; (714) 891-4004.

List Price: With 1MB RAM, VGA circuitry, one parallel port, one serial port, mouse port, \$1,575; with 1.44MB 3.5-inch floppy disk drive, MFM controller, \$1,799; with 40MB hard disk, VGA monitor, \$2,175. 1MB upgrade, \$322.

In Short: The ADC Powerlite 386SX has a highly compact passive backplane design with everything except the controller on a single card. CPU performance is good, VGA performance somewhat less so. An attractive machine if you need no disk storage beyond the internal 1.44MB floppy disk drive and hard disk.

CIRCLE 411 ON READER SERVICE CARD

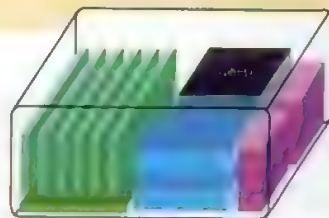
which end of the screwdriver to use when opening the case but also lists full technical details for more experienced users. A utility disk has a RAMdisk, disk cache, and expanded memory management driver, with a setup program for all three whose interface consistently leaves you uncertain which key to press next.

For resellers and adventurous users, ADC offers a completely stripped-down Powerlite model, with no hard disk, no floppy disk drive, and no controller, for \$1,575. You still get the 1MB RAM, ports, VGA, and the moderately clicky Chicony 101-key keyboard. You'll have to find DOS and a monitor for yourself. If you want a compact and elegantly designed computer and are certain that you won't want to expand it very much afterwards, the ADC is one of the most attractive choices on the market.

ADVANCED LOGIC RESEARCH INC.

PowerFlex SX386

by Alfred Poor



Thrill to the excitement of "The Computer with Two Brains!" No, it's not the latest science fiction offering from Hollywood—it's Advanced Logic Research's solution to cure premature obsolescence in the PC.

The PowerFlex SX386 starts life as a humble 12.5-MHz 286 machine with a handsome, small-footprint case and a \$1,890 price tag. Pop the top and drop a 386SX processor board into a special proprietary slot, and you have an SX machine that comes to \$2,917 for our standard configuration with a 40MB hard disk and a VGA display.

But that's not all: the PowerFlex is designed for even more upward mobility. Pull the SX board and drop in the \$2,995 80486 module for the ultimate in CPU horsepower. ALR even has a one-year buy-back promotion in which the company will give you a full \$395 credit on the SX module if you decide to turn it in for the 486 module.

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CIRCLE 250 ON READER SERVICE CARD



PowerFlex SX386

Advanced Logic Research Inc., 9401 Geronimo, Irvine, CA 92718; (800) 444-4ALR.

List Price: With 1MB RAM, 40MB hard disk, 1.44MB 3.5-inch floppy disk drive, one parallel and one serial port, disk cache utility, \$1,890; with VGA monitor, DOS 4.01, \$2,917. 1MB RAM upgrade, \$185

In Short: The PowerFlex has an intriguing design that lets you change its brain. Unlike other similar designs, this one appears affordable right through to the addition of a 486. The performance figures are underwhelming, however, and the end result is a machine that is interesting but not a compelling value.

CIRCLE 413 ON READER SERVICE CARD

Even without the 486 brain-change option, the PowerFlex has plenty in its favor. The disk controller is built into the motherboard, including embedded-AT hard disk support, along with one serial and one parallel port. The case has two half-height 5.25-inch bays, plus two 3-inch bays. The units come with a full megabyte of memory, a 40MB hard disk, and a 1.44MB 3.5-inch floppy disk drive, all as standard equipment. The case could be better; you have to remove the 3.5-inch floppy drive to get at the mounting holes for the 5.25-inch bays, but this is a small nuisance designed to save space.

The 6.25 by 14.6 by 16.6-inch (HWD) case does have some good features. The top is held on by just four screws that have knurled heads instead of the typical hex or slotted heads, so you can open the case without tools—a definite plus. These screws are also captive and cannot fall out of their holes.

286, SX, or 486?

A major factor to consider with the PowerFlex is performance. How well can it perform as a souped-up AT? In many cases, it came across the benchmark-test finish line in the second half of the pack. A notable

COMPUTERS 386SX MACHINES

exception was its fast video times, due in part to its 16-bit VGA card. The memory and processor tests were a bit off the pace, however, and the disk results landed near the middle of the pack.

And how useful is the 486 upgrade path? At present, it is quite possibly the cheapest way to get a 486 on your desk. It would appear, however, that you may pay a performance penalty compared with a 486 built from the ground up.

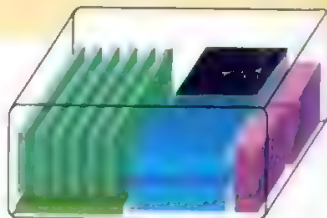
Another factor to consider is the warranty. ALR is a well-known and sizable company, yet the warranty is a simple one-year parts-and-labor coverage, and you have to ship the broken machine back to the company. There are on-site service options available at extra cost, but it seems that ALR might do well to take a page from some of its competitors and provide a more responsive and a more comprehensive form of coverage.

In the end, the PowerFlex's main attractions are its compact design and the reasonable compromise it represents between low cost and quality construction. Certainly it is an interesting machine—but it's neither a compelling value nor a sufficiently large brand name to become an overwhelming attraction.

AMERICAN MITAC CORP.

Mitac MPC 2386

by Rink Murray



American Mitac Corp. is in the habit of making solid machines and selling them at not-so-competitive prices. Mitac's first offering in the SX arena, the MPC 2386, is no exception.

If you can get past the \$3,689 price tag, setup and installation are a breeze. Mitac has gone out of its way to supply superior documentation, and it doesn't skimp on the software. The company supplies its own Advanced Disk Management System, GW-BASIC, and DOS 3.3 or later, all free of charge, and better yet, all on one

disk, with setup in ROM. Both the ADM and Setup utilities possess excellent disk- and memory-management capabilities. You can partition your disk any way you want, select varying levels of security, and choose options such as RAM shadowing and expanded memory.

The MPC 2386 is an attractive, small-footprint machine, measuring a mere 6 by

SX

Setup and Installation

are a breeze with the

Mitac MPC 2386.

American Mitac has

gone out of its way to

supply superior

documentation, and the

company doesn't skimp

on the software.

SX

16.4 by 12.6 inches (HWD). The keyboard socket and the power and reset switches are conveniently located on the front panel. Both switches feel flimsy, but rest assured that accidental contact will not engage them.

The rest of the machine is solid. The tightly integrated motherboard, Mitac's own, ships standard with Intel's 80386SX processor, 1MB page-mode interleaved RAM, an empty socket for a math coprocessor, 16-bit Super VGA circuitry, two serial ports, one parallel port, and an analog video port. The system has five 16-bit slots and one 8-bit slot, with a Conner hard disk controller occupying one 16-bit slot. A second slot was blocked by the optional 9-pin digital video port.

All this compactness does have its trade-offs. Many of the system's chips are located out of reach beneath the swappable 110/220V power supply and disk bays. So before you purchase this machine, you'd better consider how much RAM you need, because in their inconvenient position (directly beneath the floppy disk drive), these securely fastened SIP chips will not be a snap to replace.

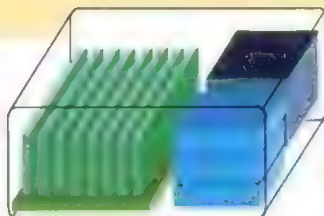
The MPC 2386 offers a variety of disk

COMPUTERS 386SX MACHINES

ARCHE TECHNOLOGIES INC.

Arche Rival 386SX

by M. David Stone



If you think only of hamburgers at the sign of a golden arch, then you probably haven't seen a computer from Arche Technologies. This is an oversight you should correct. Despite having co-opted the world's best-known arch, and despite a tendency toward punny names (such as the Arche Rival), Arche is serious about computers. In fact, it's serious enough to move away from generic computer parts and toward designing and building its own parts.

The Arche Rival 386SX provided for review already showed much of the new emphasis on Arche parts. The \$3,959 price included an Arche motherboard, Arche BIOS, Arche MIRAVGA board, Arche serial/parallel board (with two serial and one parallel port), Arche keyboard, and Arche VGA monitor.

Also included was a Microscience 28-millisecond 44MB hard disk, a Western Digital disk controller, a Faraday chip set, and 1MB of 100-nanosecond SIMMs from Texas Instruments. According to an Arche representative, the system also comes with Arche disk controllers. Current plans are for the chip set and all cards in all machines to be from Arche by the middle of 1990, with Arche power supplies following shortly. Software includes DOS 3.3 and FastLane disk cache utility—Arche's OEM version of *PC Quick*.

Arche's stated reason for moving to its own products is to ensure quality—though with parts from Western Digital and Texas Instruments, the company is clearly not cutting corners now. The Arche boards, chassis, and keyboard sport high-quality construction throughout, and the two-year warranty is also encouraging.

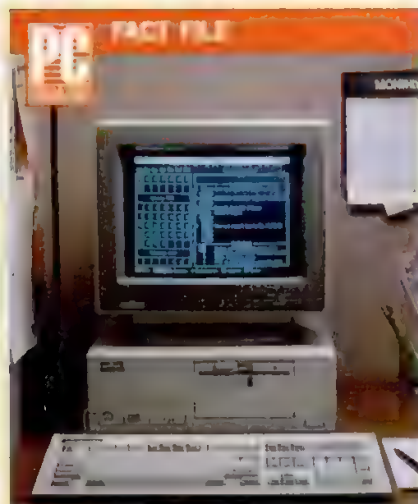
VITAL STATS

With measurements of 6.2 by 17.2 by 16.5 inches (HWD), the Arche Rival 386SX is somewhat smaller than a standard desktop

system. Still there is enough room for the usual eight slots on the motherboard—two 8-bit and six 16-bit. Three of the slots on the tested system were taken up by the VGA board, disk controller, and serial/parallel board already mentioned. Another is taken up by additional connectors attached to the serial/parallel board, leaving a total of four slots available, adequate for most expansion needs.

The Rival 386SX motherboard has eight SIMM slots, for up to 8MB RAM. The system will address up to 8MB more if you add a third-party extended memory card. Also found on the motherboard is a socket for an 80387SX math coprocessor. As tested, the system had 64K of the system ROM BIOS shadowed in RAM, but it offered no video shadowing. According to an Arche representative, video shadowing is indeed available on the board, but it was not implemented in firmware on the review machine.

Results on PC Labs' tests were on the low side of average, making the Rival 386SX a fair performer, but its scores are well within the typical range of SX machines. You can probably find other 386SX systems that list for less and deliver better performance. But, of course, list price and dealer price are not always the



Mitac MPC 2386

American Mitac Corp., 410 E. Plumeria Dr., San Jose, CA 95135, (800) 648-2287

List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, Super VGA circuitry on motherboard, one parallel port and two serial ports, DB-15 port, utilities, DOS 3.3, \$2,595; with 40MB hard disk, VGA monitor, \$3,689. 1MB RAM upgrade, \$175

In Short: A well-built space saver from a reliable vendor. A few minor complaints can be made about the feel of the machine, but nothing that affects its steady performance

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Arche Rival 386SX

Arche Technologies Inc., 48881 Kato Rd., Fremont, CA 94539; (415) 623-8100

List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, monochrome graphics monitor, two parallel and two serial ports, DOS 3.3, GW-BASIC, \$2,295; with 44MB hard disk, disk caching software, \$3,209; with VGA monitor, \$3,959. 1MB RAM upgrade, \$300

In Short: Although priced somewhat higher than some better-performing systems, the Arche Rival 386SX offers quality construction backed by a two-year warranty

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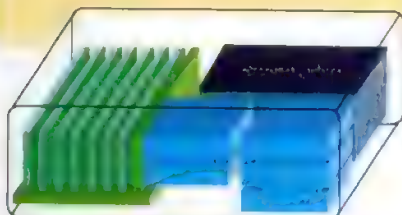
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*U.S. List Price Quantity 1.

CIRCLE 133 ON READER SERVICE CARD

same. And when you take into consideration its two-year warranty, the Arche Rival 386SX is still a good choice, if you can get it at the right price.

AST RESEARCH INC. AST Premium 386SX/16

by M. David Stone



If you've ever wished you could upgrade to a new generation of computer without losing your investment in the system you already have, take a look at AST Research's Premium 386SX/16. All components that depend on processor type or speed are on a processor board that resides in a special expansion slot.

Our standard configuration sells for \$4,385 with 1MB of 100-nanosecond RAM, a MiniScribe 40MB hard disk, your choice of either a 1.2MB or a 1.44MB floppy disk drive, and a 16-bit AST VGA Plus card and monitor, as well as two serial and one parallel port integrated onto the system board, and DOS 3.3.

The Premium 386SX/16 does not feature passive backplane design; the processor board is limited to just those components that must change with a change in processor. If you upgrade to, say, a 33-MHz 386, you pay only for those parts that actually need to be changed. In addition to the 80386SX-16, the as-tested processor board included an 82385SX-16 cache controller, 16K of 45-nanosecond cache memory, four SIMM sockets for up to 4MB RAM, and a socket for an 80387SX.

AN SX WITH AMBITION

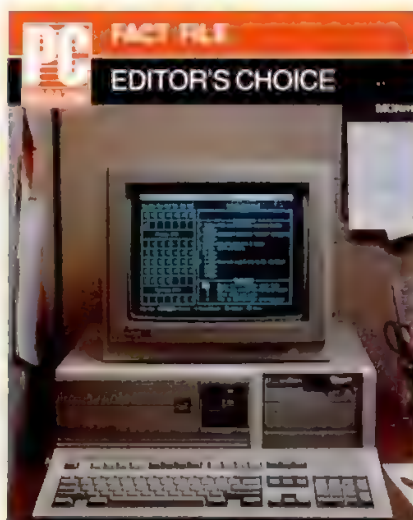
Most important, the potential for upgrading is already a reality. The chassis for the Premium 386SX/16 is the same as for the AST Premium 386/33 previously reviewed in *PC Magazine* ("High-rise Computing: 22 Powerhouse PCs Top Off at 33 MHz," October 31, 1989). You can turn the Premium 386SX/16 into a 386/33 by swapping the processor board—and add-

COMPUTERS 386SX MACHINES

ing \$4,495 for the 33-MHz board with 2MB RAM. AST has also announced a 386 25-MHz board for \$3,295 without memory, and a 25-MHz 486 card for \$6,395 with 2MB RAM.

The 6.25-by 19.25-by 16.5-inch (HWD) desktop system is slightly smaller than a standard AT-size box but still has room for five half-height drive bays, with three accessible for removable media.

The system board sports seven slots—one 8-bit, three 16-bit, and three 32-bit, which use AST's CUPID extension. The processor board goes in one of the CUPID slots, as would the optional memory board, which costs \$899 with 1MB RAM. The memory board senses which processor is in the machine and addresses the memory accordingly as 16- or 32-bit mem-



AST Premium 386SX/16

AST Research Inc., 2121 Alton Ave., Irvine, CA 92714; (714) 863-1333.

List Price: With 1MB RAM, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, one parallel and two serial ports, utilities, DOS 3.3, \$2,790; with 42MB hard disk, VGA monitor, \$4,385. 1MB RAM upgrade, \$400.

In Short: Besides being one of the best performers among the systems tested, the AST Premium 386SX 16 has the advantage of being upgradable to a full-scale 33-MHz system now, and to a 25-MHz 386 or 486 in the near future. This is a system that will be hard to outgrow.

CIRCLE 418 ON READER SERVICE CARD

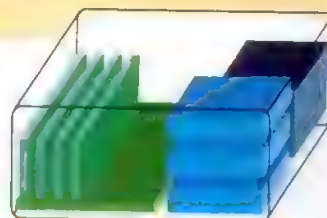
ory. It has room for 16MB RAM, but with the 386SX it can be expanded only to 12MB, giving a 16MB ceiling for the system. Also on the system board is controller support for three floppy disk drives and a connection for IDE hard disks, so that the system as tested has five slots available.

The Premium 386SX/16 was one of the fastest systems on both video and processor benchmark tests. Disk tests were solidly midrange, matching the claimed access time of 28 milliseconds.

Clearly, the Premium 386SX/16 is an attractive choice if you're interested in upgrades. But even if upgradability is not a concern, the system is very much worth looking at—for its intelligent design, quality construction, and top-tier performance.

AT&T COMPUTER SYSTEMS AT&T 6386/SX WGS

by Bill O'Brien



A casual look at the AT&T 6386/SX WGS might lead you to believe that it's just another Olivetti with an AT&T label. Pop the cover and you'll find that the heart of this small-footprint computer is not some shrunk and converted 80286 platform, but rather a deadly serious Intel motherboard replete with the latest in surface-mount technology.

Once you do lift the cover, you may at first be disappointed at the sight of only four I/O slots in this \$4,864 PC (as tested with 2MB RAM, a 40MB hard disk, VGA, and DOS). But swivel the computer around and you'll see a plethora of ports protruding from the rear panel. The VGA circuitry resides on the motherboard, as well as a pair of serial ports, a parallel port, and a mouse port. The disk drives are routed back to the motherboard too, absolving it of the need for the additional four slots typically found in full-size machines.

Performance is the hallmark of good design and a look at the benchmark test results shows you that the 6386/SX WGS is no speeding bullet. However, AT&T has addressed those aspects that directly concern the people who use the machines. While overall processor actions are relatively slow because of the poor RAM access ability (two of the eight SIMM banks were filled with 100-nanosecond Texas Instruments chips), the unit's hard disk response times on PC Labs' benchmark tests

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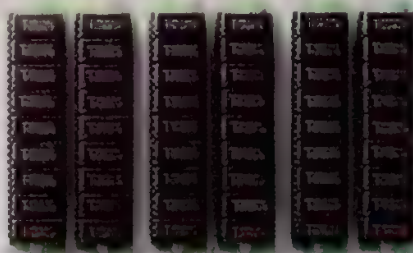
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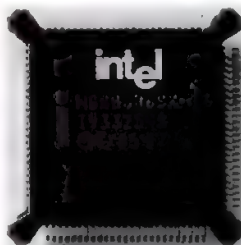
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proved to be among the fastest, especially when tested with large files. Few people will be put off by an extra second of processing time, and most will be generally impressed when a program loads with a minimum of delays. Likewise, the direct video writes to screen are pathetic, but video BIOS routines, where most programs spend their time, are more than passable.



AT&T 6386/SX WGS

AT&T Computer Systems, 1776 On the Green, Morristown, NJ 07690; (800) 247-1212.
List Price: With 2MB RAM, 1.44MB 3.5-inch floppy disk drive, VGA circuitry on motherboard, one parallel and two serial ports, PS/2-compatible mouse connector, \$2,995; with 40MB hard disk, VGA monitor, DOS 3.3, \$4,864. 2MB RAM upgrade, \$1,295.

In Short: A fast performer backed by AT&T's name and service (and pricing) aimed at the corporate or institutional user. Surface-mount technology gets lots of ports onto the motherboard, but there's only one drive bay open for expansion.

CIRCLE 417 ON READER SERVICE CARD

Even the 101-key keyboard is unobtrusive, being neither too soft nor too stiff, with a generous 96-inch cable.

And you'll find no disappointments in the 6386/SX's manual either. It's a techie's dream come true, with detailed explanations of machine operations and segment addressing, all aimed at giving you as much latitude in configuring the equipment as possible. AT&T has even bundled a diagnostic disk into the deal.

On the downside, there is but a single half-height bay available for expansion. It's likely intended for a high-density 5.25-inch floppy disk drive, as the base unit comes with a one-third-height 1.44MB floppy drive. Replacing existing components can also be awkward. Aside from the restrictions of the one-third-height bay, the hard disk—a 3.5-inch Quantum drive—is

COMPUTERS 386SX MACHINES

couched in a custom cutout that fits it squarely.

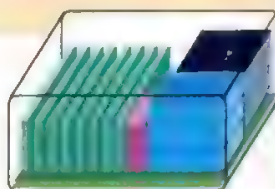
I would trade the easy access of the front-mounted power and reset buttons for a more durable on/off switch. With the cover off, a careless swipe of my hand in passing tore off the plastic button top. It pushed back on easily enough, but it now dangles loosely.

Pricing may also set you back. The test-ed unit's \$2,995 price tag includes neither a monitor nor DOS. These add \$1,869 to the tag, raising the price of a 2MB system to a hefty \$4,864. For its target group of systems houses, this price may be irrelevant, but it is steep for an SX computer if you're not a staunch AT&T aficionado.

AUSTIN COMPUTER SYSTEMS INC.

Austin 386SX

by Bruce Brown



The decision to buy a 386SX is tough enough in these days of falling 20-MHz 386 system prices without having to be concerned about individual components or the vendor from whom you buy the system. Austin Computer Systems' 386SX combines excellent components at very competitive prices with comprehensive user and computer support and service policies.

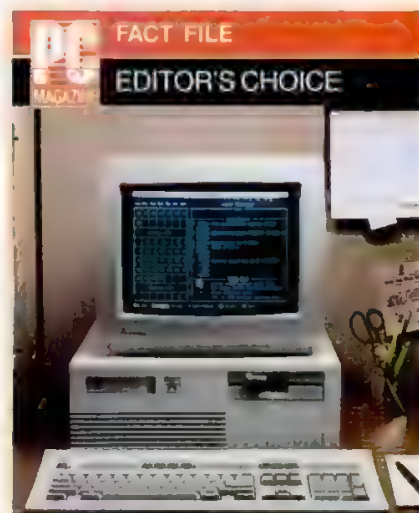
The Austin 386SX is a small-footprint desktop machine measuring 6.4 by 16 by 16.25 inches (HWD). The standard configuration, with a 28-millisecond 42MB hard disk, your choice of a 1.2MB or 1.44MB floppy disk drive, a Mitsubishi VGA monitor, DOS 3.3 or 4.01, and a GE on-site service contract, costs a reasonable \$2,195.

The Austin system uses a motherboard of its own design with AMI ROM BIOS. The motherboard can take a maximum 8MB RAM; the review unit featured 80-nanosecond SIMMs with both 256-kilobit and 1-megabit memory chips. The memory uses page-mode interleaving for near

zero-wait-state performance, averaging 0.2 wait states with 80-ns. memory, or 0.4 wait states with 100-ns.-rated memory, according to an Austin spokesperson. You also can select system ROM shadowing to gain an additional boost. PC Labs tests confirm this, as the Austin 386SX finished well in the processor and memory benchmark tests.

The Austin 386SX has two 8-bit expansion slots and six 16-bit slots. In the tested system, two of the 16-bit slots hold a 16-bit Western Digital VGA card and an 8-bit combined Western Digital drive controller and system I/O card. The Western Digital hard disk is an IDE-interface unit with a built-in 8K read-ahead buffer, which can significantly improve drive performance with applications that employ sequential data access. On the disk segments of PC Labs benchmark tests, Austin's SX scores were unexceptional. The case has room for three half-height drives and one vertically mounted 3.5-inch storage device.

Austin gives you a choice of keyboards, all 101-key designs with 12 function keys across the top. Unless you specify otherwise, you'll get a Chicony keyboard with a 72-inch cable, but you can also choose from Key Tronic or NMB Hi-



Austin 386SX

Austin Computer Systems Inc., 10300 Metric Blvd., Austin, TX 78758; (800) 752-1577, (512) 339-7932.

List Price: With 1MB RAM, 42MB hard disk, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, monochrome monitor, one parallel and two serial ports, utilities, DOS 3.3, \$1,695; with VGA monitor, \$2,195. 1MB RAM upgrade, \$199.

In Short: The Austin 386SX has it all: good performance, standard parts at excellent prices, fine expandability, and a full year's on-site service contract. If a 386SX makes sense to you, this may be the one to consider.

CIRCLE 418 ON READER SERVICE CARD

Tek keyboards if you prefer one of those units.

Austin sells computers primarily through mail order, although some systems are sold through VARs. Austin offers a 30-day no-questions-asked money-back guarantee, along with a toll-free technical help hotline and the on-site service. If you want to extend the warranty and GE on-site service contract, you can buy additional years of coverage for 10 percent of the original system purchase price per year. Austin doesn't require that you pay for extended contract coverage when you buy the computer, only that you pay for the new coverage before your current contract expires.

When you combine this excellent support and the attractive pricing with Austin's faster-than-average performance, quality components, expansion possibilities, and "made in America" philosophy, it's easy to give the Austin 386SX an unqualified recommendation.

BUS COMPUTER SYSTEMS INC.

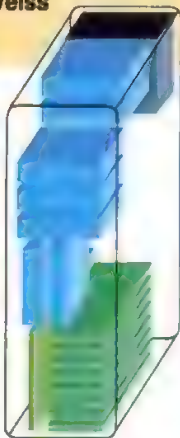
Bus 386/SX

by Henry Fersko-Weiss

The Bus 386/SX is a computer with great potential for expansion. It has eight slots, eight punch-outs for other connectors, and room for seven half-height drives inside its tower case.

What's most impressive about the huge potential of this machine is its tiny price. Our standard configuration, with 1MB RAM, a 40MB hard disk, a 1.2MB floppy disk drive, VGA monitor, one serial and one parallel port, and DOS 4.01, costs only \$2,200. At that price the computer is competitive with 286-based computers running at 16 MHz. In fact, the one AT-compatible that Bus Computer Systems sells is only \$100 cheaper than its 386/SX.

If you load the system up to give it the proper profile for a low-cost file server, it is still incredibly inexpensive. Put in 8MB



COMPUTERS 386SX MACHINES



Bus 386/SX

Bus Computer Systems Inc., 135 W. 26th St., 8th Fl., New York, NY 10001; (212) 627-4485.

List Price: With 1MB RAM, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, one parallel and one serial port, DOS 4.01, \$1,220; with 40MB hard disk, VGA monitor, \$2,200. 1MB RAM upgrade, \$175.

In Short: The Bus 386 SX has great expansion capacity (seven half-height drive bays and eight slots), and it also has a wonderful price. But the system's performance is only average, and the inside of the machine is a bit cramped in spite of its lower case.

CIRCLE 419 ON READER SERVICE CARD

total RAM, a 330MB hard disk, a 150MB internal tape drive, a second serial port, and another high-density drive, and it costs only \$6,325.

To allow room for expansion potential, the Bus 386/SX comes in a tower case that stands 24.75 inches tall by 7 inches wide by 16.75 inches deep. This is a slightly slimmer profile than some tower cases have, which makes it a nice desk-side companion. And it's easy to operate without getting out of your chair because the switches, LED indicators, and a large digital read-out for the speed are on the front. The switches include a convenient turbo button for changing between 8 and 16 MHz clock speeds.

The inside of the Bus 386/SX isn't quite as nicely laid out. The drive bays back into the chunky power-supply box, leaving little space for you to get at the drive connectors. The cabling for the floppy and hard disks is stuffed in behind the lower hard disk bays rather than being tied up out of the way. This makes it difficult to get to one of the 16-bit slots.

There are eight expansion slots in the computer; five are available. One slot is

used for the 16-bit ViewPoint VGA card from Everex; a combination Western Digital floppy/hard disk controller sits in the second; and the third slot is used for the parallel and serial port. A second serial port can be hung out of a cutout.

The rest of the Bus 386/SX innards are fairly standard. The 1MB of system memory in the unit we tested consists of 100-nanosecond 256-kilobit DRAM chips packaged as SIMMs, with the motherboard holding up to 8MB. The RAM is in page-mode interleaved arrangement, which results in near-zero-wait-state operation.

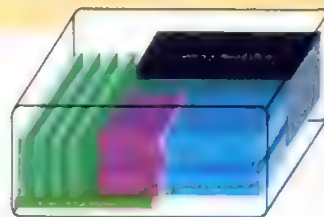
One unusual feature of the computer is the keyboard. It's manufactured for Bus Computer Systems with two sets of 12 function keys, one set on the left and the other across the top. It's a welcome redundancy for fans of the old AT keyboard.

Where the Bus 386/SX falls down somewhat is in performance. It lands in the middle of the speed curve on the PC Labs benchmark tests, with video scores lagging toward the bottom. But if you can accept this average performance, you can have a computer with tremendous expansion potential at an exceptional price.

DATA GENERAL CORP.

Dasher/386sx

by Bruce Brown



Data General Corp.'s experience in building large computer systems carries over to the design of its new Dasher/386sx. The structural design components and details give the impression that this is one sturdy computer, built for heavy use. The case front has many cooling vents; a larger-than-normal power supply puts out an ample 185 watts, and there's plenty of room inside the case for air circulation among the four drive bays and expansion slots.

The system certainly does not come cheaply. A 2MB RAM Dasher/386sx system with our standard configuration—40MB hard disk, 1.44MB 3.5-inch floppy disk drive, VGA monitor, and DOS 3.3—

CONTINUES

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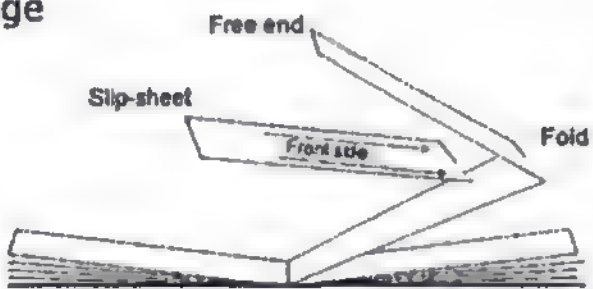
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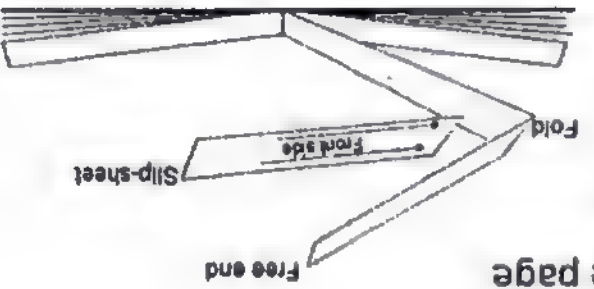
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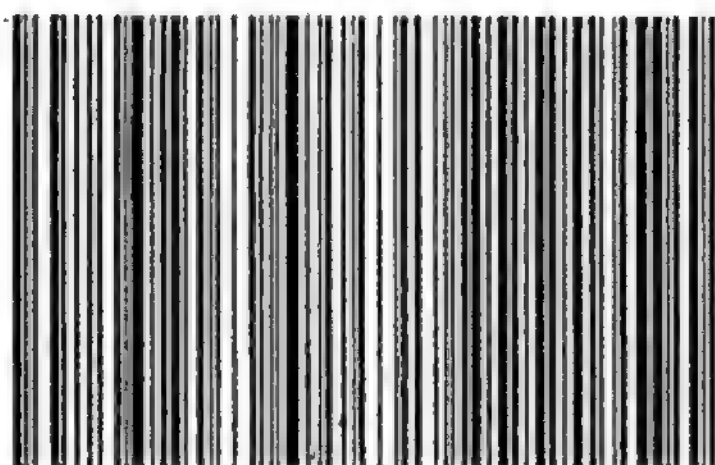
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PC LABS BENCHMARK SERIES R

	Instruction Mix	Floating Point Calculation
ZEOS 386SX/16	4.08	6.98
IBM PS/2 Model 50Z	5.68	11.21
Compaq Deskpro 386S	4.48	9.67

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10 Good Reasons To Buy From ZEOS®

Reason #1

"Overall Excellence."

As *PC Magazine* said "Price is always a consideration. So are benchmark test results. But both factors can be deceiving, which is why we consider them in the context of other aspects that will make the difference months and years down the road."

These are the attributes which *PC Magazine* used in awarding ZEOS the coveted Editor's Choice, not once but three times. And "Overall Excellence" are the very words *PC Magazine* used in describing ZEOS systems comparing them to all others.

Reason #2

Dazzling Performance.

In one recent review, *PC Magazine* awarded ZEOS Editors Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in another review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world."

Dazzling Performance is built into every ZEOS system. It's a key component of ZEOS Overall Excellence.

Reason #3

Exceptional Quality.

PC Resource Magazine put it this way, "ZEOS... provides quality comparable with IBM or Compaq and does so for about 70% of the price." ZEOS uses only the very best components. And every system is fully tested and burned-in right in our own labs.

Reason #4

Value.

InfoWorld says, "We find the ZEOS '386 an excellent value. Speed: Excellent. Compatibility: Excellent.



Value: Excellent."

Personal Computing said, "ZEOS... is the best value we've come across... its performance is right up there with the slickest, most expensive PCs you can buy."

Reason #5

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Reason #6

24 Hour Toll Free Technical and Sales Support.

At ZEOS, the customer is #1. That's why we're open around the clock. For your convenience. If you buy a product from us we feel we should be there to help, 24 Hours a day. Our Help Lines are Toll Free too. Because you shouldn't have to pay for the call.

Reason #7

Experience.

Almost unique in the mail order computer industry, ZEOS maintains its own chip level Research and Development staff. In addition to Systems Manufacturing, we also operate our own Board Level Manufacturing facility.

ZEOS has been involved in Research and Development since our incorporation back in 1981. Our strong and experienced Research, Manufacturing and Technical Staff translates into superior factory direct computer systems for you.

Reason #8

A Sterling Reputation.

In magazine after magazine and review after review ZEOS systems are sighted for Overall Excellence, for Excellent Value, as the Right Choice and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The systems and the support. That means more to us than anything.

Reason #9

Easy to Buy.

ZEOS systems are easy to buy. You can pick up the phone any time of the day or night and order your new ZEOS computer. And we accept MasterCard, Visa, and Corporate Purchase Orders from Fortune 1000 Companies, Colleges, Universities and Governments. Complete Leasing Programs are available as well.

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Reason #10

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will set you back a whopping \$4,490.

The Dasher/386sx is a small-footprint desktop machine, measuring just 6.5 by 17.4 by 16.25 inches (HWD). The computer has only a keylock and power-on indicator on the front of its case. There is no reset switch, and the power switch is located on the right side.

Look inside the Dasher/386sx and you'll find Data General's own motherboard, which uses Phoenix's ROM BIOS with setup in ROM. You can turn system and video ROM shadowing on or off independently; each uses 128K RAM when active. There's room for 8MB RAM on the motherboard. The memory in the tested configuration is 1-megabit 100-nanosecond chips in SIMM packaging, and the system memory is interleaved for performance improvement, similar to most 386SX systems. The interleaving does not have a tremendous effect on performance. While a competent performer, the Dasher/386sx did not set any speed records on the PC Labs benchmark tests.

System expansion is limited, with just four slots—one 8-bit and three 16-bit. Because the controllers for the video system, floppy disk drive, and I/O ports are built into the motherboard, however, all four slots are free in the standard system. The

COMPUTERS 386SX MACHINES

case also has plenty of room for two half-height 5.25-inch drive bays and two 3.5-inch drive bays.

Our test system had a Conner Peripherals 28-millisecond 43MB hard disk featuring an IDE interface with an integrated floppy/hard disk controller. This controller uses a 1:1 interleave, with an 8K look-ahead buffer to speed up sequential data access. Disk performance was competent but unexceptional on our testing.

The Dasher's integrated video chip set is by Chips and Technologies; in our test system, it ran a Data General VGA monitor, which has a convenient text-mode switch on the front of the case. The Fujitsu 101-key keyboard has the standard 12 function keys across the top and a 72-inch cable.

Data General's computers are sold only by its direct sales force and through VARs.

SX

Epson's combination of VGA graphics card and monitor proved to be one of the fastest. As for computing ability, the results from the three processor-based tests place the Equity 386SX high among the list of contenders.

SX

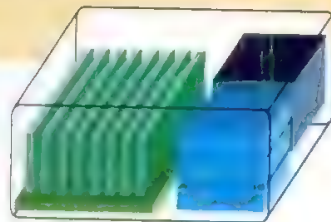
All repair service is done at the manufacturing site in Massachusetts unless you specify an optional 4-hour on-site service contract. The standard one-year warranty covers parts and labor.

The Dasher/386sx is a competent computer. As a LAN workstation or stand-alone machine, it should serve you well. Data General's list price is high, but since the unit is sold directly by a vendor sales force, discounts are probably negotiable. Assuming that you can get a price break, the Dasher/386sx is a highly recommended machine that ought to keep you computing for a long time.

EPSON AMERICA INC.

Epson Equity 386SX

by Bill O'Brien



Nearly a decade ago Epson America was a printer company that couldn't make two vertical lines print next to each other. Now its printers have become one of the industry's standards for compatibility, and Epson has diversified into computers—hoping to achieve the same market penetration.

Its newest PC offspring is the Epson Equity 386SX, a pricey (\$4,297) small-footprint system well-equipped to win a place in the soon-to-be-glutted SX market.

This 6.6-by-19.6-by-17.4-inch (HWD) system is one of the most intelligently designed machines you'll ever find. The keyboard connector is mounted on the face of the unit, as are the power and reset buttons and also the CPU speed select switches. The Equity also sports a PS/2-style mouse connector port as standard equipment. Three half-height bays exit the front, and the standard floppy disk drive is a 3.5-inch 1.44MB model.

Lift the lid and you'll find the clean, uncluttered environment for which Epson is known. The motherboard is Epson's own creation, and it includes an on-board disk controller. The model submitted to PC Labs for testing had a 40MB IDE hard disk that produced throughput performance numbers ranking in the top third of all machines tested.

Epson also supplies its own VGA graphics card and monitor—a combination that proved to be one of the fastest overall when you take into account all phases of the text-based exercise. As for computing ability, the results from the three processor-based tests place the Equity 386SX high among the long list of capable contenders.

EXTRAS AT A PRICE

Other welcome features include a tactile and responsive 101-key keyboard that is a delight to use. And Epson hasn't slouched in the software department, either: bun-



Dasher/386sx

Data General Corp., 4400 Computer Dr., Westborough, MA 01581; (508) 366-8911.
List Price: With 2MB RAM, 1 44MB 3.5-inch floppy disk drive, one parallel and two serial ports, VGA controller, utilities, DOS 3.3, \$2,900; with 2MB RAM, 43MB hard disk, VGA monitor, \$4,490. 2MB RAM upgrade, \$975.

In Short: Sold directly to corporate accounts and by VARs, Data General's Dasher/386sx is a conventional 386SX machine in a small-footprint case that's built to last. The system's relatively high price may well be discounted.

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Arts & Letters Graphics Editor 1.02 (Computer Support Corp.)	80	3.0/1.0	87	80	84	79	78	79	76	82	74	78	90	76
Micrografx Designer 2.0 (Micrografx Inc.)	78	6.3/1.0	84	80	80	77	73	78	78	81	74	74	78	77
Kinetic Art 1.20G (Kinetic Presentations Inc.)	76	11.8/2.0	92	83	80	67	76	64	58	76	87	83	63	78
Artline 1.0 (Digital Research Inc.)	72	3.7/1.0	87	77	81	70	71	69	61	74	70	62	63	67
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Drawing/editing	(100)	Excellent	Good	Satisfactory	Very Good
Documentation	(100)	Very Good	Good	Good	Good
Ease of learning	(100)	Satisfactory	Satisfactory	Satisfactory	Good
Ease of use	(75)	Good	Good	Good	Good
Error handling		Satisfactory	Satisfactory	Good	Poor
Support	(50)	Good	Very Good	Good	Good
Support policies	(50)	Good	Satisfactory	Excellent	Very Good
Technical support	(75)	Poor	Satisfactory	8.0	8.8
Value		5.8	5.7		7.2
Final scores					

Highest Ranking Score!

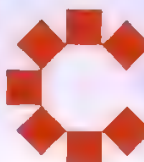
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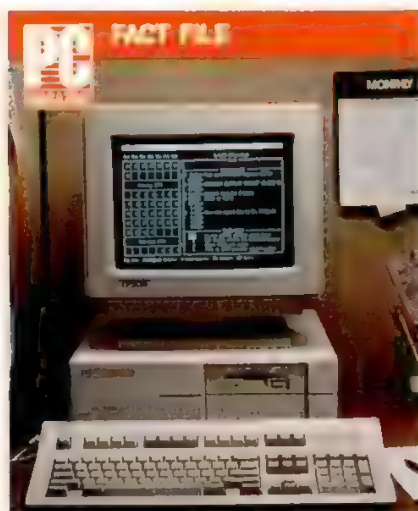
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COMPUTERS 386SX MACHINES

dled with the machine are DOS and Epson's own diagnostic utilities. You can also exercise the machine's abilities with OS/2 Version 1.0, available from Epson at additional cost.

However, it is difficult to shout about the Equity's superb performance and extra features without taking other matters into consideration. A look at the features table will quickly alert you to the fact that the Equity 386SX is one of the highest priced computers in this review. And like most other machines reviewed here, the tested unit does not include an 80387SX coprocessor (you can't purchase one from Epson, either). And while I can praise the proprietary memory expansion slot, I find it difficult to believe that there is a real need for the proprietary parallel/serial card slot.

Ten months ago, the Epson Equity 386SX would have been a credible performer at a competitive price in the SX arena. Today, it is still a credible machine posting performance times that few can match, but its high-end list price places it into real 80386 territory, where 32-bit bus design and expansion capability make it look slightly pale by comparison. If you simply must have this machine, try to purchase it at a discount price.



Epson Equity 386SX

Epson America Inc., 2780 Lomita Blvd., Torrance, CA 90505; (800) 922-8911.

List Price: With 1MB RAM, one 1.44MB 3.5-inch floppy disk drive, one parallel port, one serial port, mouse port, utilities, DOS 4.01, \$2,299; with 40MB hard disk, VGA monitor, \$4,297. 1MB RAM upgrade, \$599.

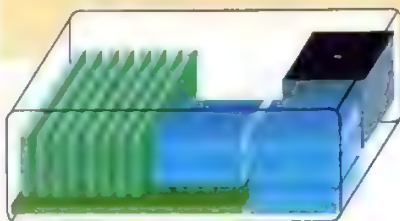
In Short: While technically capable, the Epson Equity 386SX is priced well into the real 80386 arena without the expansion capabilities and performance that would be available from a true 32-bit processor.

CIRCLE 421 ON READER SERVICE CARD

GATEWAY 2000

386SX Gateway 2000 Multiperformer

by Bill O'Brien



There's no doubt that the folks at Gateway really want you to buy their computer. The prodigiously named 386SX Gateway 2000 Multiperformer, with a 14-inch Crystal Scan VGA monitor, carries a nominal \$2,295 price tag.

The only option you could realistically cut from the machine we tested is the second floppy disk drive for an additional \$100 savings. (If you're really on a budget, you could downgrade to a 20MB hard disk and save another \$200, but a 386 environment with only 20MB is like a Ferrari with a 5-gallon gas tank!)

The exterior of the box could very well pass for an AT, and a look under the hood could fool you as well. The machine is built around a full-sized FTK motherboard with a Chips and Technologies NEAT chip set and AMI BIOS. The motherboard can hold 8MB of 1-megabit SIMMs; the tested machine carried 70-nanosecond chips that turned in excellent performance times in the memory and processing benchmark tests.

The 16-bit ATI VGA Wonder card also gave superb performance throughout all aspects of the video tests; my only complaint was the color monitor sent along with the system. Gateway claims 1,024 by 768 resolution for the Crystal Scan, and the version of *Microsoft Windows/386* that I installed for a VGA display certainly showed crisp images with no blurred or turned edges.

However, the monitor itself did not produce a bright graphics display. The screen had a softer, less intense image—especially in the white areas of the background, which appeared to be tinted slightly blue. This eccentricity was most noticeable when I compared the Crystal Scan with some of the other monitors displaying the same image. The effect wasn't unplea-

sant—just different—and normal text mode was not affected in the least.

DISK DILEMMAS

The low cost of the system might lead you to suspect that there is one anchor-dragging performance; it comes from the Seagate ST-251 40MB hard disk, which arrived divided into two partitions with DOS 4.01 installed. The ST-251 doesn't have the worst track-to-track access rating of the group, but the combination of the hard disk and the Data Technology Corp.'s controller resulted in some of the worst throughput times of any machine tested.

If you're willing to spend some extra bucks to improve the situation, switch from the ST-251, with its standard ST-506 interface and MFM encoding, to the op-



386SX Gateway 2000 Multiperformer

Gateway 2000, 106 W. 8th St., P.O. Box 2000, Sergeant Bluff, IA 51054; (800) 523-2000, (712) 943-2000

List Price: With 2MB RAM, 20MB hard disk, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, monochrome monitor, one parallel and two serial ports, \$1,405; with 40MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, VGA monitor, DOS 4.01, \$2,295. 1MB RAM upgrade, \$250.

In Short: The 386SX Gateway 2000 Multiperformer is a reasonable entry-level machine, but the buyer should seriously consider replacing the hard disk with a faster unit that will more closely match the system's ability.

CIRCLE 422 ON READER SERVICE CARD

tional Seagate 65MB RLL drive and controller offered by Gateway.

The Key Tronics keyboard has a mellow feel, adding to the attractions that beckon anyone in search of an entry-level 386 to the Gateway 2000. And the low cost will please prospective buyers on a tight budget. If you fit into either category, Gateway is one of the places for your buck to stop.

Usually, the technology available to computer users just plods along—with competing products repeating one another's so-called improvements.

But once in a blue moon there's a great leap of innovation. Something new appears that's so well thought out, so

smart, that the way you work may never be the same again.

WIZ™ by CalComp, for example.

WIZ is an exciting new productivity tool. Combining the easy-to-use features of a mouse with the power of an "intelligent" graphics pad to enhance every pointing, tracing

and drawing function you do.

WIZ meets the needs of virtually every Macintosh and PC user—from novice to advanced. Because WIZ gives you the convenience and flexibility of six programmable buttons, a cross-hair pointer and 1000 dpi for pinpoint accuracy, along with

Prehistoric.



a user-definable mouse area.

What's more, WIZ unleashes the full power and speed of your software. Optional templates for most major programs eliminate tedious pull-down or bar menus. Because WIZ templates put the commands you use most at your fingertips for

instant access. And for the artist in you, WIZ offers an optional pen for drawing.

There's no rolling ball or moving parts. Nothing to clean. And WIZ has a five year warranty backed by CalComp, a world leader in computer graphics for over 30 years.

But the most amazing thing about WIZ is that you get it all for an introductory price under \$200.

See WIZ at your local dealer or call 800-CALCOMP.

WIZ by CalComp. Everything else is just a mouse.



Historic.





386SX COMPUTERS: SUMMARY OF FEATURES

(Products listed in alphabetical order by company)

The following commentary analyzes some of the terms in this table of features. The phrases in bold type are listed in the same order as in the left-hand column of the table.

In addition to the questions answered by the table, note that all of these computers support the use of an 80387SX coprocessor.

Standard configuration price For the sake of price comparisons, our configuration includes 1MB RAM, a 40MB hard disk, one high-density floppy disk drive, color VGA video display, at least one parallel and one serial port, a keyboard, and DOS. In some instances, manufacturers do not offer the exact configuration PC Magazine requested, but all 31 of

the PCs reviewed here provide a reasonably close match for this list of requirements. Check each machine's fact file for a more exact indication of what is included at the quoted price.

Case type indicates whether each computer has a small-footprint, desktop, or tower design.

The **system RAM arrangement** is the method in which memory is addressed. Remember that CPU speed is usually faster than conventional memory speed.

Interleaved memory increases processing

speed by dividing the memory into two or four portions that process information alternately. The CPU sends information to one section for processing while another section goes through a refresh cycle.

Page-mode memory allows back-to-back memory accesses within blocks of memory called *pages* without wait states.

Row/column is the traditional method of accessing data at a memory address, with the RAM being mapped as a matrix and a particular address being given using a row and a column number.

	Acer America Corp. Acer 1100/SX	Advanced Digital Corp. Powerlite 386SX	Advanced Logic Research Inc. PowerFlex SX386	American Mitac Corp. Mitac MPC 2386	Arche Technologies Inc. Arche Rival 386SX	PC AST Research Inc. AST Premium 386SX/16	AT&T Computer Systems AT&T 6386/SX WGS
Price of standard configuration	\$3,265	\$2,175	\$2,917	\$3,689	\$3,959	\$4,385	\$4,864
TESTED CONFIGURATION							
Case type	Small-footprint	Small-footprint	Small-footprint	Small-footprint	Small-footprint	Desktop	Small-footprint
Dimensions (HWD, in inches)	5 x 14.2 x 16.2	4 x 11.5 x 15	6.3 x 14.6 x 16.6	6 x 12.6 x 16.4	6.2 x 17.1 x 16.5	6.3 x 19.3 x 16.5	6.3 x 14 x 15.8
Motherboard manufacturer	Acer	ADC	ALR	Mitac	Arche	AST	Intel
System RAM arrangement	Interleaved, row/column	Interleaved, page-mode	Page mode	Interleaved, page-mode	Interleaved	Page-mode	Interleaved, page-mode
Wait states	0	0	0	0	0	0	0
MOTHERBOARD MEMORY							
Installed RAM	1MB	1MB	5MB	1MB	1MB	1MB	2MB
Maximum installable RAM	8MB	5MB	5MB	8MB	8MB	4MB	8MB
RAM packaging (and rated speed)	SIMM (100 ns.)	DIP (100 ns.)	SIMM, DIP (80 ns.)	SIP (100 ns.)	SIMM (100 ns.)	SIMM (100 ns.)	SIMM (100 ns.)
Chip size	256Kb, 1Mb	256Kb	1Mb	256Kb	256Kb	256Kb	1Mb
ADD-IN BOARD MEMORY							
Installed RAM	N/A	None	N/A	N/A	N/A	None	N/A
Maximum installable RAM	N/A	4MB	N/A	N/A	N/A	12MB	N/A
RAM packaging (and rated speed)	N/A	DIP (100 ns.)	N/A	N/A	N/A	SIMM (100 ns.)	N/A
Chip size	N/A	256Kb	N/A	N/A	N/A	256Kb	N/A
PROCESSOR RAM CACHE							
Cache controller	None	None	None	None	None	Discrete logic	None
Installed RAM	N/A	N/A	N/A	N/A	N/A	16K	N/A
RAM packaging (and rated speed)	N/A	N/A	N/A	N/A	N/A	DIP (45 ns.)	N/A
Chip size	N/A	N/A	N/A	N/A	N/A	8Kb	N/A
Maximum installable RAM	N/A	N/A	N/A	N/A	N/A	16K	N/A
BIOS							
BIOS version and date	Award BIOS 3.03SX (June 1989)	Quadtel BIOS 3.03.02 (July 1989)	Phoenix BIOS 3.10.01 (January 1988)	Phoenix BIOS 3.07 (June 1986)	Arche BIOS SXVX.04 (September 1989)	AST BIOS 1.0 (August 1989)	Phoenix BIOS 1.10 16.E1B (August 1989)
Setup in ROM	■	■	■	■	■	■	■
Password in ROM	□	□	□	□	■	■	■
System shadowing/Can be disabled	■/■	■/■	■/■	■/■	■/■	■/■	■/■
Video shadowing/Can be disabled	■/■	■/■	■/■	■/■	□/□	■/■	■/■

■—Editor's Choice ■—Yes □—No

N/A — Not applicable: the product does not have this feature.

COMPUTERS

386SX MACHINES

Wait states On the average, most machines run between zero and one wait state. The figures printed here were supplied by the respective manufacturers.

Maximum installable RAM Separate rows indicate the maximum 32-bit memory possible for a 386-based PC—or the maximum 16-bit memory for a 386SX machine—on the motherboard and on a dedicated memory board, as well as the maximum size of the processor RAM cache.

RAM packaging (and rated speed) Memory chips come in a variety of styles: DIPs, SIPs, and SIMMs.

The *dual in-line package (DIP)* is the traditional buglike computer chip sprouting 8, 14, 24, 40 or more metal legs (evenly divided between right and left sides).

Single in-line packages (SIPs) are single-package arrays of computer chip logic assembled so that all connecting legs are in a straight line, like the teeth on a comb. They can be individual chips or multiple chips on a small card, with a proprietary SIP connection. Similar to SIPs are *ZIPs (zig-zag in-line packages)*, in which every other pin connection is slightly offset, creating a zig-zag pattern.

Single in-line memory modules (SIMMs) are individual logic devices that are installed on their own small circuit board, creating a

component module that can be plugged into a larger device. Their physical arrangement facilitates easy installation and replacement.

Chip size Kb and Mb refer to kilobits and megabits, respectively.

Processor RAM cache A processor RAM cache acts as a bridge between the CPU and the slower main memory. The cache comprises a small bundle (typically 32K to 128K) of fast SRAM chips. The cache controller is designed to predict and retrieve the data the CPU is likely to require next, thus preventing wait states. There are two varieties

Austin Computer Systems Inc. Austin 386SX \$2,195	Bus Computer Systems Inc. Bus 386/SX \$2,200	Data General Corp. Dasher/386sx \$4,490	Epson America Inc. Epson Equity 386SX \$4,297	Gateway 2000 386SX Gateway 2000 Multiperformer \$2,295	IBM Corp. IBM PS/2 Model 55SX \$4,668	Intelligent Data Systems Inc. IDS PC-386SX-40 \$1,995	Lanier Business Systems Lanier 386/16 SX \$3,895	Mitsubishi Electronics America Inc. Mitsubishi MP386s \$5,195
Small-footprint 6.4 x 16 x 16.3 Austin Interleaved, page-mode, row/column 0	Tower 24.8 x 7.1 x 16.6 Bus Interleaved, page-mode 0	Small-footprint 6.5 x 17.4 x 16.5 Data General Interleaved, row/column 0	Small-footprint 6.1 x 15.7 x 16.4 Epson Row/column 0.5	Desktop 6.5 x 21 x 16.5 FTK Interleaved, row/column 0	Small-footprint 4 x 16 x 15.6 IBM Page-mode 0	Desktop 6.5 x 21.3 x 17 Copam (IDS) Row/column 0.5	Small-footprint 5 x 18 x 12 Lanier Interleaved, row/column 0.5	Small-footprint 6.1 x 15 x 15 Mitsubishi Row/column 0
1MB 8MB SIMM (80 ns.) 256Kb, 1Mb	1MB 8MB SIMM (100 ns.) 256Kb	4MB 8MB SIMM (100 ns.) 1Mb	1MB 1MB SIP (70 ns.) 256Kb	2MB 8MB SIMM (70 ns.) 1Mb	2MB 4MB SIMM (100 ns.) 1Mb	1MB 4MB DIP (80 ns.) 256Kb, 1Mb	4MB 4MB SIMM (100 ns.) 256Kb, 1Mb	2MB 2MB SIMM (100 ns.) 1Mb
N/A N/A N/A N/A	N/A N/A N/A N/A	N/A N/A N/A N/A	N/A N/A N/A N/A	N/A N/A N/A N/A	N/A N/A N/A N/A	N/A N/A N/A N/A	None 4MB Info not available Info not available	6MB 6MB SIMM (100 ns.) 1Mb
None N/A N/A N/A N/A	None N/A N/A N/A N/A	None N/A N/A N/A N/A	None N/A N/A N/A N/A	None N/A N/A N/A N/A	None N/A N/A N/A N/A	None N/A N/A N/A N/A	None N/A N/A N/A N/A	None N/A N/A N/A N/A
AMI BIOS DVS X 6063 (April 1989)	Award BIOS 3.04 (June 1988)	Phoenix BIOS 1.10.03 (January 1988)	Epson BIOS 1.03 (July 1989)	AMI FTK 386 BIOS (April 1989)	IBM BIOS Version A (January 1988)	Phoenix BIOS 3.10.00 (January 1988)	Phoenix BIOS 1.10.01 (January 1988)	Phoenix BIOS 3.10.00 (April 1989)
■ □ ■/■ □/□	■ □ ■/■ ■/■	■ □ ■/■ ■/■	□ ■ □/□ □/□	■ □ ■/■ ■/■	□ □ ■/■ □/□	■ □ ■/■ ■/■	■ □ ■/■ ■/■	□ □ ■/■ ■/■

CONTINUES



386SX COMPUTERS: SUMMARY OF FEATURES

(Products listed in alphabetical order by company)

of controllers: discrete logic chips (designed by the individual manufacturers) and VLSI chips like the Intel 82385.

The **BIOS version and date** can affect PC Labs' benchmark test results. Those purchasing the same machine with a different BIOS version may encounter some variations in performance.

Setup can reside either on a floppy disk or in ROM.

Shadowing Shadow RAM is a technology that loads system BIOS and/or video BIOS directly into fast RAM on boot-up of the computer, offering enhanced performance speed at the cost of 384K of memory from the

first 1MB of system RAM. The ability to disable shadowing is important with some applications to resolve memory conflicts.

Bus speeds Bus speed becomes more important as computers run at faster clock speeds. A computer's bus speed may actually be too fast for expansion cards, most of which operate at 8 MHz. Note that the Micro Channel bus operates at 14.5 MHz.

The **display circuitry location** can be either on an expansion card or on the motherboard. Motherboard circuitry is often faster, but if it cannot be disabled it prevents upgrades.

Interface 16-bit video interfaces are typically faster than 8-bit because of their wider band width.

Software available For DOS, OS/2, and *Microsoft Windows/386*, the version number and list price are provided. DOS 3.3 or 4.01 is automatically included as part of *PC Magazine's* standard configuration for computers.

Disk cache software Some companies provide software to facilitate data retrieval from the hard disk. This software speeds overall system performance by anticipating what data the processor will need next.

	MultiMicro Inc. MMI16SX	NCR Corp. NCR PC386sx	NEC Information Systems NEC PowerMate SX Plus	Pan United Corp. Micro Lab 386/SX	PC Designs Inc. PC Designs GV386SX	Polywell Computers Poly 386SX	Softworks Development Corp. Citus 386sx TS
Price of standard configuration	\$2,299	\$5,039	\$4,398	\$2,199	\$3,435	\$2,150	\$2,930
TESTED CONFIGURATION							
Case type	Small-footprint	Small-footprint	Small-footprint	Desktop	Small-footprint	Desktop	Tower
Dimensions (HWD, in inches)	6.5 x 14 x 16.5	5.5 x 15 x 16.8	4.8 x 17 x 16	7 x 21 x 17	4.5 x 16.5 x 16	6.7 x 21.2 x 16.5	25.3 x 7.5 x 17
Motherboard manufacturer	Precise	NCR	NEC	Datatech	PC Designs	Orchid Technology	Softworks
System RAM arrangement	Page-mode, row/column	Page-mode	Interleaved, row/column	Interleaved, page-mode	Interleaved, page-mode	Interleaved, page-mode	Interleaved, page-mode
Wait states	0	1	0.6	0	0	0	0
MOTHERBOARD MEMORY							
Installed RAM	1MB	1MB	2MB	1MB	4MB	1MB	1MB
Maximum installable RAM	8MB	15MB	10MB	8MB	4MB	8MB	8MB
RAM packaging (and rated speed)	SIP (100 ns.)	SIMM (80 ns.)	ZIP (80 ns.)	SIMM (100 ns.)	DIP (100 ns.)	SIMM (80 ns.)	SIMM (80 ns.)
Chip size	256Kb, 1Mb	256Kb	1MB	256Kb, 1Mb	1Mb	256Kb	256Kb, 1Mb
ADD-IN BOARD MEMORY							
Installed RAM	N/A	N/A	N/A	N/A	N/A	N/A	None
Maximum installable RAM	N/A	N/A	N/A	N/A	N/A	N/A	8MB
RAM packaging (and rated speed)	N/A	N/A	N/A	N/A	N/A	N/A	SIMM (100 ns.)
Chip size	N/A	N/A	N/A	N/A	N/A	N/A	1Mb
PROCESSOR RAM CACHE							
Cache controller	None	None	None	None	None	None	None
Installed RAM	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RAM packaging (and rated speed)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chip size	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Maximum installable RAM	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BIOS							
BIOS version and date	AMI BIOS DNSX-500Y 043089 (April 1989)	NCR BIOS 1.1 (July 1989)	Phoenix BIOS 1.011.05 (August 1989)	Award BIOS 3.04 P24 (June 1988)	AMI NEAT 386SX Plus (April 1989)	AMI BIOS 1.0A (February 1989)	AMI BIOS 043089 (April 1989)
Setup in ROM	■	■	□	■	■	■	■
Password in ROM	□	■	■	□	□	□	□
System shadowing/Can be disabled	■ / ■	□ / □	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
Video shadowing/Can be disabled	■ / ■	□ / □	■ / ■	■ / ■	■ / ■	■ / ■	□ / □

■ —Editor's Choice ■ —Yes □ —No

N/A — Not applicable; the product does not have this feature.

COMPUTERS

386SX MACHINES

An **expanded memory manager** is software that emulates the Lotus-Intel-Microsoft (LIM) expanded memory manager within the extended memory of a 386 or 386SX PC.

Switchable settings on the power supply are designed to permit a computer's use in both the United States and Europe.

Number of device connectors indicates how many internal storage devices the system can support without the use of Y-cables (power splitters).

Hard disk options The number of different hard disks the vendor offers for a machine is

often indicative of how much customizing is available. We are listing what we believe are the most popular disk choices (40MB, 80MB, 100MB, 120MB, 300MB, 600MB, or the vendors' closest available models).

Within the 386 PC environment, the three most common hard disk interfaces are *ST-506*, *SCSI* (small computer system interface), and *ESDI* (enhanced small device interface). ST-506 uses one of two data encoding methods, *RLL* (run length limited) and the older *MFM* (modified frequency modulation) scheme. All data is encoded onto and read from your hard disk as a series of polarity-reversing bits representing ones and zeros. The MFM format uses nine such bits to store the same amount of data that RLL can store with only six polarity

changes.

Both SCSI and ESDI require special hard disk controllers and cannot run off existing PC-XT or PC AT controllers. A new interface that offers good performance at a lower price than ESDI or SCSI is *IDE* (interface design enhancements).

FCC certification class Two classes of FCC (Federal Communications Commission) approval, Class A and Class B, may be given to computers. Class A approval signifies that a computer has sufficiently low radio-frequency emissions for operation in a business locale. The more stringent Class B rating allows home use as well, where computers are likely to be placed near radios and television sets.

Sunburst Systems Inc. Sunburst 386SX-16 \$2,149	Tandon Computer Corp. Tandon PAC 386sx \$4,087	Tandy Corp. Tandy 4000 SX \$2,599	Tangent Computer Inc. Tangent 316SX \$2,413	Tatung Company of America Inc. Tatung TCS-8800S \$1,995	UTI Computers UTI 386 SX \$2,126	Wang Laboratories Inc. Wang PC 350/16S \$4,620	 Zeos International Zeos 386SX-16 \$2,252
Small-footprint 5.5 x 17 x 16 Orchid Technology	Tower 15.3 x 6.3 x 16 Tandon	Desktop 6.3 x 17 x 16 Tandy	Desktop 6.5 x 21.3 x 16.8 Mylex	Small-footprint 17.3 x 16.3 x 5.9 Tatung	Desktop 5.5 x 21 x 16 UTI	Small-footprint 6.3 x 16 x 16.3 Wang	Desktop 6.3 x 19 x 16.5 Zeos
Interleaved, page-mode 0	Interleaved, page-mode 0.5	Page-mode 1	Interleaved, page-mode 0.5	Interleaved, page-mode 0	Interleaved, page-mode 0	Interleaved, page-mode 0.5	Interleaved, page-mode 0
2MB 8MB SIMM (100 ns.) 256Kb	1MB 8MB SIMM (100 ns.) 256Kb, 1Mb	N/A N/A N/A N/A	4MB 8MB SIMM (100 ns.) 256Kb, 1Mb	1MB 8MB SIMM (100 ns.) 256Kb, 1Mb	N/A N/A N/A N/A	1MB 8MB SIMM (100 ns.) 256Kb, 1Mb	1MB 4MB DIP (60 ns.) 256Kb
N/A N/A N/A N/A	N/A N/A N/A N/A	1MB 8MB SIMM (100 ns.) 256Kb, 1Mb	N/A N/A N/A N/A	N/A N/A N/A N/A	1MB 8MB SIP, DIP (80 ns.) 256Kb, 1Mb	None 16MB SIMMS (100 ns.) 256Kb	N/A N/A N/A N/A
None N/A N/A N/A N/A	None N/A N/A N/A N/A	None N/A N/A N/A N/A	None N/A N/A N/A N/A	None N/A N/A N/A N/A	None N/A N/A N/A N/A	None N/A N/A N/A N/A	None N/A N/A N/A N/A
AMI BIOS 1.0A (February 1989)	Tandon BIOS V302 3.2 (August 1989)	Phoenix BIOS 01.05.0 (April 1989)	Phoenix BIOS 0.10.02 (January 1988)	Phoenix BIOS 1.10.03 (January 1988)	Award BIOS 3.03 aAT (September 1987)	Phoenix BIOS 1.10.00 (June 1989)	AMI DiNT 6051033089-k8 (March 1989)
■ □ ■/■ ■/■	■ ■ ■/■ ■/■	□ □ ■/□ ■/□	■ □ ■/■ ■/■	■ □ ■/■ ■/■	■ □ ■/■ ■/■	□ □ ■/■ ■/■	■ □ ■/■ ■/■

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PHOTOGRAPH BY WILLIAM "Photograph" (1999) is a black and white photograph of a man in a suit, standing in a room with a large window. The man is looking out the window, and his reflection is visible in the glass. The photograph is framed by a thick black border.



**When you want to know
all about a computer
system ... Ask
Dr. Jerry Pournelle.***

Put a machine in Pournelle's workshop. He'll soon tell you everything you want to know about it with no punches pulled.

Recently, Dr. Pournelle looked at Northgate's 80386 Pipeline Page Mode system and reported in BYTE July, 1989 (excerpted):

*Jerry Pournelle holds a doctorate in psychology and is a writer who also earns a comfortable living writing about computers present and future.



"... the case is sturdy, and the motherboard construction is clean and neat. The boards are thick: I've seen some clones with boards so thin they wave in the breeze."

"... I like this machine a lot."

"... The workmanship is superior."

"... there sure wasn't any installation required for this system. I just turned it on, and it came up in MS-DOS 4.01."

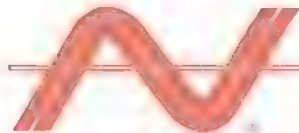
[a software program] ... "which is all graphics is almost twice as fast on the Northgate 80386 as on my other machines. So is Windows ..."

"... I rate the Northgate 80386 as better than good enough on CPU and disk speed and wow! on video speed."

"... I have reports from other people who have Northgate computers, and they're happy."

"... All in all, the Northgate 80386 looks like one of the best deals in town."

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COMPUTERS

386SX MACHINES



386SX COMPUTERS: SUMMARY OF FEATURES

(Products listed in alphabetical order by company)

	Acer America Corp. Acer 1100/SX	Advanced Digital Corp. Powerlite 386SX	Advanced Logic Research Inc. PowerFlex SX386	American Mitac Corp. Mitac MPC 2386	Arche Technologies Inc. Arche Rival 386SX	 AST Research Inc. AST Premium 386SX/16	AT&T Computer Systems AT&T 6386/SX WGS
HARD DISK							
Manufacturer	Miniscribe	Toshiba	Western Digital	Conner	Microscience	Miniscribe	Quantum
Disk capacity	42MB	44MB	40MB	40MB	44MB	42MB	42MB
Interface	IDE	MFM	ST-506	MFM	MFM	RLL	IDE
Controller location	Motherboard	Card	Motherboard	Motherboard	Card	Hard disk	Motherboard
Controller manufacturer	Acer	ADC	ALR	Mitac	Western Digital	Miniscribe	Intel
Integrated floppy/hard disk controller	■	■	■	□	■	■	■
Drive bays	4 half-height	2 half-height	4 half-height	4 half-height	3 half-height	5 half-height	2 half-height, 1 one-third-height
FLOPPY DISK DRIVES							
Type	1.2MB	1.44MB	1.2MB	1.2MB	1.2MB	1.2MB	1.44MB
Manufacturer	Panasonic	TEAC	TEAC	NEC	TEAC	TEAC	Panasonic
EXPANSION BUS							
Bus speeds (MHz)	8	4.77, 8, 10	8	10	8	8	8
Expansion slots	Four 16-bit	Four 16-bit	One 8-bit, five 16-bit	One 8-bit, five 16-bit	Two 8-bit, six 16-bit	One 8-bit, three 16-bit, three 32-bit/16-bit	One 8-bit, three 16-bit
Slots free with hard and floppy drives, video, two serial and one parallel port installed	4	1	4	5	6	5	4
Ports originate on motherboard	■	■	■	■	□	■	■
VIDEO							
Display circuitry location	Motherboard	Motherboard	Card	Motherboard	Card	Card	Motherboard
Interface	16-bit	16-bit	16-bit	16-bit	8-bit	16-bit	8-bit
Manufacturer	Paradise	ADC	ALR	Mitac	Arche	AST Research	Cirrus Logic
Chip set manufacturer	Paradise	Chips and Technologies	Paradise	Paradise	Cirrus Logic	Paradise	Cirrus Logic
KEYBOARD							
Manufacturer	Acer	Chicony	BTC	Mitac	Arche	AST Research	AT&T
Number of keys	101	101	101	101	101	101	101
Number of function keys	12	12	12	12	12	12	12
Keyboard cable length (inches)	60	60	84	60	76	111	96
SOFTWARE AVAILABLE							
DOS	3.3 (included)	None	4.01 (\$119)	3.3 (included)	3.3 (included)	3.3 (\$95)	None
OS/2	1.1 (\$350)	None	None	None	None	1.1 (\$325)	None
Microsoft Windows/386	2.1 (included)	None	None	None	None	None	None
Disk cache software	■	■	■	□	■	■	□
Expanded memory manager	■	■	■	■	■	■	□
Other	Utilities	Utilities	None	Advanced Disk Management System 1.03	None	None	Diagnostics, utilities

 —Editor's Choice ■ —Yes □ —No

COMPUTERS

386SX MACHINES



Austin
Computer
Systems Inc.
Austin 386SX

Bus Computer
Systems Inc.
Bus 386/SX

Data General
Corp.
Dasher/386sx

Epson America
Inc.
Epson Equity
386SX

Gateway 2000
386SX
Gateway 2000
Multiperformer

IBM Corp.
IBM PS/2
Model 55SX

Intelligent
Data Systems
Inc.
IDS
PC-386SX-40

Lanier
Business
Systems
Lanier
386/16 SX

Mitsubishi
Electronics
America Inc.
Mitsubishi
MP386s

Western
Digital

42MB

IDE

Card

Western
Digital



4 half-height

Seagate

43MB

MFM

Card

Western
Digital



7 half-height

Conner

43MB

IDE

Motherboard

Data General



4 half-height

Conner

40MB

IDE

Hard disk

Conner



3 half-height

Seagate

41MB

MFM

Card

DTC



5 half-height

IBM

30MB

ESDI

Motherboard

IBM



2 half-height

Seagate

43MB

MFM

Card

Western
Digital



5 half-height

Western
Digital

42MB

IDE

Motherboard

Lanier



3 half-height

Mitsubishi

42MB

MFM

Motherboard

Mitsubishi



3 half-height

1.2MB

Chinon

1.2MB

TEAC

1.44MB, 1.2MB

TEAC

1.4MB

Epson

1.2MB, 1.44MB

TEAC

1.44MB

IBM

1.2MB

TEAC

1.44MB

Panasonic

1.2MB

Mitsubishi

8

Two 8-bit,
six 16-bit

6



8

Two 8-bit,
six 16-bit

5



8

One 8-bit,
three 16-bit

4



8

One 8-bit,
four 16-bit,
two proprietary

3



8

Two 8-bit,
six 16-bit

5



14.5

Three MCA

3



8

Three 8-bit,
five 16-bit

5



8

Two 8-bit,
four 16-bit

3



6, 8

Six 16-bit

4



Card

16-bit

Western Digital

Paradise

Card

16-bit

Everex

Trident

Motherboard

16-bit

Data General

Chips and
Technologies

Card

16-bit

Epson

Paradise

Card

16-bit

ATI

ATI

Motherboard

8-bit

IBM

IBM

Card

16-bit

ATI

ATI

Card

8-bit

Paradise

Paradise

Card

16-bit

Video Seven

Video Seven

Chicony

101

12

72

Bus Computer

114

24 (2 x 12)

94

Fujitsu

101

12

72

Epson

101

12

96

Key Tronic

101

12

72

IBM

101

12

72

Copam

101

12

80

Key Tronic

101

12

96

Key Tronic

101

12

80

3.3 (included)

None

2.1 (\$139)



Utilities

4.01 (\$75)

None

None



None

4.01 (included)

None

2.1 (\$235)



None

4.01 (included)

1.1 (\$325)

None



Setup,
diagnostics

4.01 (included)

None

None



None

3.3 (\$125)

1.2 (\$340)

None



None

3.3 (included)

None

None



None

3.3 (\$150)

None

None



None

3.3 (included)

None

None



None

CONTINUES

COMPUTERS

386SX MACHINES



386SX COMPUTERS: SUMMARY OF FEATURES

(Products listed in alphabetical order by company)

	MultiMicro Inc. MMI16SX	NCR Corp. NCR PC386sx	NEC Information Systems NEC PowerMate SX Plus	Pan United Corp. Micro Lab 386/SX	PC Designs Inc. PC Designs GV386SX	Polywell Computers Poly 386SX	Softworks Development Corp. Citrus 386sx TS
HARD DISK							
Manufacturer	Toshiba	Rodime	NEC	Seagate	Toshiba	Seagate	Micropolis
Disk capacity	42MB	41MB	42MB	40MB	44MB	42MB	160MB
Interface	MFM	MFM	ST-506	MFM	MFM	MFM	ESDI
Controller location	Card	Motherboard	Card	Card	Card	Card	Card
Controller manufacturer	Western Digital	NCR	NEC	Western Digital	Western Digital	DTC	Western Digital
Integrated floppy/hard disk controller	■	■	□	■	■	■	■
Drive bays	4 half-height	3 half-height	3 half-height	5 half-height	2 half-height, 2 one-third-height	5 half-height	7 half-height
FLOPPY DISK DRIVES							
Type	1.2MB	1.44MB	1.2MB	1.2MB	1.44MB, 1.2MB	1.2MB	1.2MB, 1.44MB
Manufacturer	TEAC	TEAC	NEC	TEAC	Toshiba	TEAC	Chinon
EXPANSION BUS							
Bus speeds (MHz)	6, 8, 16	8	8	8	8, 16	8	8
Expansion slots	Three 8-bit, five 16-bit	Four 16-bit	Four 16-bit	Two 8-bit, six 16-bit	Two 8-bit, three 16-bit	Two 8-bit, four 16-bit, one proprietary	Two 8-bit, six 16-bit
Slots free with hard and floppy drives, video, two serial and one parallel port installed	5	4	2	5	2	3	5
Ports originate on motherboard	□	■	■	□	□	□	□
VIDEO							
Display circuitry location	Card	Motherboard	Motherboard	Card	Card	Card	Card
Interface	16-bit	16-bit	16-bit	16-bit	16-bit	16-bit	16-bit
Manufacturer	Video Seven	NCR	NEC	Video Seven	Tseng Labs	Orchid Technology	Western Digital
Chip set manufacturer	Video Seven	Paradise	Paradise	Video Seven	Tseng Labs	Tseng Labs	Paradise
KEYBOARD							
Manufacturer	Key Tronic	NCR	NEC	Chicony	MaxiSwitch	Chicony	MaxiSwitch
Number of keys	101	101	101	101	101	101	104
Number of function keys	12	12	12	12	12	12	12
Keyboard cable length (inches)	80	103	60	96	72	87	72
SOFTWARE AVAILABLE							
DOS	3.3 (\$85)	3.3 (\$95)	3.3 (included)	3.3 (\$85)	4.01 (\$79)	3.3 (\$65)	4.01 (included)
OS/2	None	None	1.0 (\$325)	None	None	None	None
Microsoft Windows/386	None	None	2.1 (included)	None	None	None	None
Disk cache software	□	■	□	□	□	■	□
Expanded memory manager	□	□	□	□	□	■	□
Other	None	None	None	Utilities	None	Utilities	None

□—Editor's Choice ■—Yes □—No

COMPUTERS

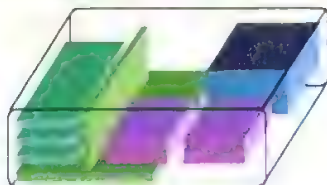
386SX MACHINES

Sunburst Systems Inc. Sunburst 386SX-16	Tandon Computer Corp. Tandon PAC 386sx	Tandy Corp. Tandy 4000 SX	Tangent Computer Inc. Tangent 316SX	Tatung Company of America Inc. Tatung TCS-8800S	UTI Computers UTI 386 SX	Wang Laboratories Inc. Wang PC 350/16S	 Zeos International Zeos 386SX-16
Toshiba 41MB MFM Card AMS ■	Tandon 40MB RLL Card Tandon □	Miniscribe 40MB MFM Motherboard Tandy ■	Toshiba 67MB MFM Card Adaptec ■	Control Data 90MB ESDI Card Adaptec □	Mitsubishi 43MB MFM Card DTC ■	Conner 40MB MFM Motherboard Wang ■	Seagate 65MB RLL Card Adaptec ■
5 half-height	2 full-height, 1 half-height	2 half-height, 2 one-third-height	5 half-height	4 half-height	5 half-height	3 half-height	7 half-height
1.2MB, 1.44MB TEAC	1.2MB Toshiba	1.44MB Sony	1.2MB TEAC	1.2MB, 1.44MB Matsushita, TEAC	1.2MB, 1.44MB Mitsumi	1.2MB, 1.44MB Mitsubishi	1.2MB TEAC
8 Two 8-bit, four 16-bit	8 One 8-bit, four 16-bit	8 Five 16-bit	8 One 8-bit, seven 16-bit	8 Three 8-bit, four 16-bit	8 Two 8-bit, five 16-bit	8 Two 8-bit, four 16-bit	8 Two 8-bit, six 16-bit
3	2	4	6	3	3	5	5
□	■	■	■	□	□	■	□
Card 8-bit Orchid Technology Orchid Technology	Card 16-bit Video Seven Video Seven	Card 8-bit Western Digital Paradise	Card 16-bit Video Seven Video Seven	Card 16-bit Western Digital Paradise	Card 16-bit ATI ATI	Card 8-bit Wang Tseng Labs	Card 16-bit Zeos Paradise
China Keyboard 101 12 72	Hi-Tek 101 12 70	Tandy 101 12 60	Key Tronic 101 12 100	Forward Electronics 101 12 120	Mitsumi 101 12 93	Honeywell 101 12 120	Man Tan Computer 101 12 72
DR-DOS 3.4 (included) None None ■ ■ None	3.3 (included) None 2.1 (included) □ ■ None	3.3 (\$120) 1.0 (\$325) None □ ■ SCO Xenix (\$795)	3.3 (\$88) None None □ ■ None	3.3 (included) None None ■ ■ None	None None None □ □ Utilities	3.3 (\$100) 1.1 (\$340) 2.1 (\$120) □ ■ SCO Xenix 386 (\$695)	4.01 (included) None None □ ■ None

CONTINUES

IBM CORP. IBM PS/2 Model 55SX

by Tom Unger



At first glance, IBM's PS/2 Model 55SX seems like a natural bridge between the world of 286 and 386 computing. This small-footprint Micro Channel machine, with its familiar 4- by 16- by 15.75-inch (HWD) IBM-gray case, appears to have all the right ingredients to make it a contender in the SX market—and for one segment of that market, it does.

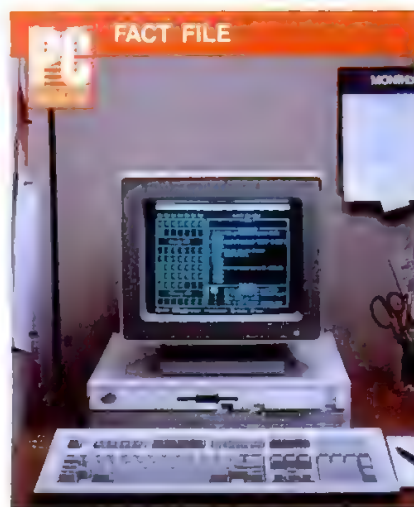
The 55SX ships standard with a 30MB hard disk, 2MB of DRAM SIMMs socketed onto the motherboard, a 1.44MB floppy disk drive, on-board VGA graphics, and a horizontal three-slot expansion chassis. It also includes a serial, parallel, and

mini-DIN bus-mounted mouse port built right into the motherboard. The motherboard itself is compact and well-organized, making strong use of surface-mount chip technology.

IBM can also take credit for the modular construction of the system's insides. The whole thing—drives, cards, motherboard—can be taken apart in about 2 minutes, and you barely need a screwdriver to do it.

But wait. A closer look at the unit—priced at \$4,518 including a VGA monitor, though widely available for up to 25 percent less—may lead you to conclude that the 55SX is more notable for its cost, performance, and expansion limitations than for anything else.

If you're looking for a machine that will grow with your office needs, the 55SX may disappoint—in spite of its modularity. The system lacks bays for additional tape, fixed, or floppy disk drives. Adding any one of these externally will cost you an expansion slot. Should you wish to add memory above the 4MB motherboard limit, you must take up another slot with IBM's memory expansion card. Add



IBM PS/2 Model 55SX

IBM Corp., contact your local authorized IBM dealer; (800) IBM-2468.

List Price: With 2MB RAM, 30MB hard disk, 1.44MB 3.5-inch floppy disk drive, VGA monitor, one parallel port, one serial port, one bus mouse port, utilities, \$4,518; with DOS 3.3, \$4,668. 1MB RAM upgrade, \$695.

In Short: IBM's SX unit gives you solid construction, middle-of-the-road performance, and near-the-top pricing. Even with the loaded motherboard, some users may feel constrained by getting just three expansion slots. The 60MB hard disk is slow, at 39 milliseconds.

CIRCLE 423 ON READER SERVICE CARD



386SX COMPUTERS: SUMMARY OF FEATURES

(Products listed in alphabetical order by company)

	Acer America Corp. Acer 1100/SX	Advanced Digital Corp. Powerlite 386SX	Advanced Logic Research Inc. PowerFlex SX386	American Mitac Corp. Mitac MPC 2386	Arche Technologies Inc. Arche Rival 386SX	AST Research Inc. AST Premium 386SX/16	AT&T Computer Systems AT&T 6386/SX WGS
PHYSICAL FEATURES							
Power supply (watts)	145	80	180	150	200	220	145
Switchable settings	115V/230V	125V/230V	110V/220V	110V/220V	125V/230V	125V/230V	125V/230V
Number of device connectors	5	2	4	4	4	4	3
Keyboard lock	Front	None	None	Front	Front	None	Software
Case lock	Front	None	None	None	None	Back	Front
Power-on switch	Front	Back	Front	Front	Side	Side	Front
Reset switch	Front	Front	None	Front	Front	Front	Front
Hard disk options	40MB, 100MB (IDE)	40MB, 100MB (ST-506)	40MB (ST-506)	40MB, 100MB (ST-506)	44MB, 80MB (ST-506); 122MB, 320MB, 760MB (ESDI)	40MB, 110MB (ST-506); 320MB (ESDI)	40MB, 80MB (ESDI)
SUPPORT							
Warranty	1 year	1 year	1 year	1 year	2 years	1 year	1 year
Service	Four months on-site; later, return to dealer	Ship to manufacturer	Return to dealer	Return to dealer	Return to dealer	Return to dealer	Ship to manufacturer
FCC certification	B	A	B	A	B (pending)	B	B

■ —Editor's Choice ■ —Yes □ —No

IBM's 8514 graphics adapter card, and you're looking at a full house.

AVERAGE TEST SCORES

Also disappointing is the Model 55SX's average performance on the benchmark tests, where it ranked 14th out of 32 machines that were tested in completing the sample instruction mix, even with the system BIOS shadowed into RAM. (Note that the video BIOS can't be shadowed into RAM.) And the access time of the 60MB hard disk included in our test machine is rated at a poky 39 milliseconds—the same speed that the first AT's hard disk had back in 1984.

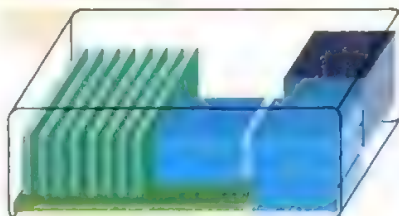
Finally, to call the thin booklet that accompanies this machine "documentation" is like calling a spoonful of rice a meal. The generic tutorial diskette is much the same, giving few specifics about the machine itself.

IBM's long experience at targeting the business user shows in the Model 55SX. Put the small-footprint machine on a desk, stick in a network card, and work. For that market, where expandability isn't really an issue, the machine succeeds. For the individual user who wants a PC that can grow, the Model 55SX isn't the best solution.

INTELLIGENT DATA SYSTEMS INC.

IDS PC-386SX-40

by Bruce Brown



If price is paramount and extensive memory capacity is not an issue, Intelligent Data Systems' PC-386SX-40 may be one of the better deals around. The IDS machine lists at just \$1,995 for a configuration that includes 1MB RAM, a 43MB hard disk, a 1.2MB floppy disk drive, a color VGA setup, one parallel and two serial ports, one game port, and either DOS 3.3 or 4.01.

The system comes in a full-sized AT-like desktop case that measures 6.5 by 21.25 by 17 inches (HWD). The front of the case has a flush-mounted reset switch, a system keylock, power, hard drive ac-

cess, and system speed lights. The case has room for five half-height 5.25-inch floppy disk drives, three of which have exposed fronts ready for removable media.

MEMORY ISSUES

The IDS motherboard, made by its parent company, COPAM Electronics, uses Phoenix ROM BIOS chips. As with most SX systems, the IDS PC-386SX-40 uses memory interleaving, as well as video and system ROM BIOS shadowing. The board takes either 256-kilobit or 1-megabit, 80-nanosecond DIP chips; it will accommodate only 4MB.

This limitation seems strange in a large-format case that offers eight expansion slots and room for five drives. Two of the three 8-bit and three of the five 16-bit slots remained free in the test system. Not one of the slots is a dedicated memory slot; hence, if you need more than the 4MB motherboard limit, you can fill one slot with a 16-bit memory card, but this memory will be slower, running at only the speed of the bus.

IDS included a Western Digital 1:1 interleave MFM combination floppy/hard disk controller, as well as a Seagate 43MB, 28-millisecond hard disk and a



Austin Computer Systems Inc. Austin 386SX	Bus Computer Systems Inc. Bus 386/SX	Data General Corp. Dasher/386sx	Epson America Inc. Epson Equity 386SX	Gateway 2000 386SX Gateway 2000 Multiperformer	IBM Corp. IBM PS/2 Model 55SX	Intelligent Data Systems Inc. IDS PC-386SX-40	Lanier Business Systems Lanier 386/16 SX	Mitsubishi Electronics America Inc. Mitsubishi MP386e
200	250	185	110	200	90	200	100	154
125V/230V	125V/230V	125V/230V	110V/220V	125V/230V	125V/230V	125V/230V	125V/230V	125V/230V
4	5	4	3	4	2	4	4	3
Front	Front	Front	None	Front	None	Front	Front	Front
Front	None	Front	None	Front	Side	Front	None	Front
Back	Front	Side	Front	Side	Front	Side	Side	Front
Front	Front	None	Front	Front	None	Front	None	Front
72MB, 110MB, 160MB, 330MB (IDE)	40MB, 60MB, 80MB, 120MB (ST-506); 150MB, 300MB (ESDI)	40MB, 100MB (IDE)	40MB, 100MB (ST-506)	80MB (ST-506); 150MB, 200MB, 300MB (ESDI)	30MB, 60MB (ESDI)	80MB (ST-506); 150MB (ESDI)	40MB (IDE)	40MB (ST-506)
1 year	2 years	1 year	1 year	1 year	1 year	1 year	90 days	1 year
On-site	Ship to manufacturer	Ship to manufacturer	Return to dealer	On-site	On-site	Ship to manufacturer	On-site	Return to dealer
A	A	B	B	A	B	A	A	B

CONTINUES

In your wildest dreams, if you could do absolutely anything you wanted with your data files, what would you do?

You'd want to organize them, of course.

Manage them, too.



From time to time you'd probably need to look for them.

But most of the time, you'd just want to look *at* them—or through them—instantly.

Occasionally you might even want to send them to someone else so they could look at them, too.

Or transfer them to your laptop so you could play with them at home. Or away from home.

Naturally, you'd want to be able to do all of these things without having to do much of anything yourself.

Maybe pull down a menu, hit a couple of keys or

**Near-Perfect
DOS shell
Emerges as
Market's Best**

*InfoWorld thought the world of Version 2.0.
The new Norton Commander is even
better—and even easier to learn and use.*

THE NORTON COMMANDER

VERSION 3.0

nudge your mouse every so often.

Seeing is relieving.

Well, stop dreaming. Because the new Norton Commander® has arrived and it's better than anything else you can use to deal deftly with DOS.

In fact, the new Norton Commander is so good, it's even better than the old Norton Commander.

Which is pretty remarkable, considering that *InfoWorld* called the original version "tops in its class... a new level of convenience for MS/DOS users."

They called Version 2.0 "a near-perfect DOS shell... the market's

best... recommended for all DOS users, regardless of expertise."

We can't wait to see what the critics will say about our latest version.

And neither should you.

**Now you see it.
Now you don't have to.**

The new Norton Commander combines all the functions of a hard disk manager with all the features you need to support and enhance

the DOS command line.

Yet it's flexible enough to adjust totally to your style of working—even get out of your way entirely when you don't need to see it.

MCI®

*With just a couple of keystrokes,
our new Commander Mail lets
you instantly exchange files,
telexes and E-mail with any MCI
Mail subscriber. And you can fax
to any machine in the world.*

Your wish is our Commander.

But since the new Norton Commander can do so many things for you, you'll probably be seeing a lot of it.

Like those times when you want to browse through the contents of your files, but you haven't the time—or the patience—to load and run the applications that created the files in the first place.

Thanks to our ingenious File Viewers, all you have to do now is

tree view of your directories, a list of your last 15 commands, or a menu of your favorite programs and routines.

What could be easier? Faster? More efficient?

Certainly nothing we've heard of.

Armed with the fax.

Speaking of things you haven't heard of before, imagine using a DOS manager to send faxes to any of the world's 4,000,000 or so fax machines.

Dream on, right? Wrong. Our new

some mileage out of your modem for a change.

You'll definitely get more mileage out of your laptop PC.

Because the Norton Commander adapts to your laptop's LCD display characteristics.

And our new Commander Link™ lets you transfer files from desktop to laptop—and back—quickly and easily.*

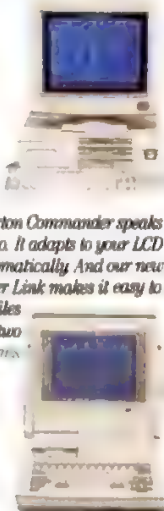
So before you go back to dealing with DOS the hard way, see your favorite software dealer.

If you haven't got a favorite software dealer, call us right away at 1-800-365-1010.

And order us around.

Peter Norton
COMPUTING

The new Norton Commander speaks laptop, too. It adapts to your LCD display automatically. And our new Commander Link makes it easy to transfer files between two systems.



Want to see what's in your files without running the application? With our ingenious File Viewers, your data is as close as a keystroke. Version 3.0 supports most leading business applications.

Commander Mail™ not only lets you do that, it lets you instantly exchange files, telexes and E-mail with any MCI Mail® subscriber—in Milwaukee, in Mongolia, even in Marketing. Without having to laboriously load and run one of those complex communications programs.

What's more, Commander Mail checks your E-mailbox, downloads messages to your disk and even beeps to let you know when you have a message.

Automatically, of course.

Who knows, you may actually get

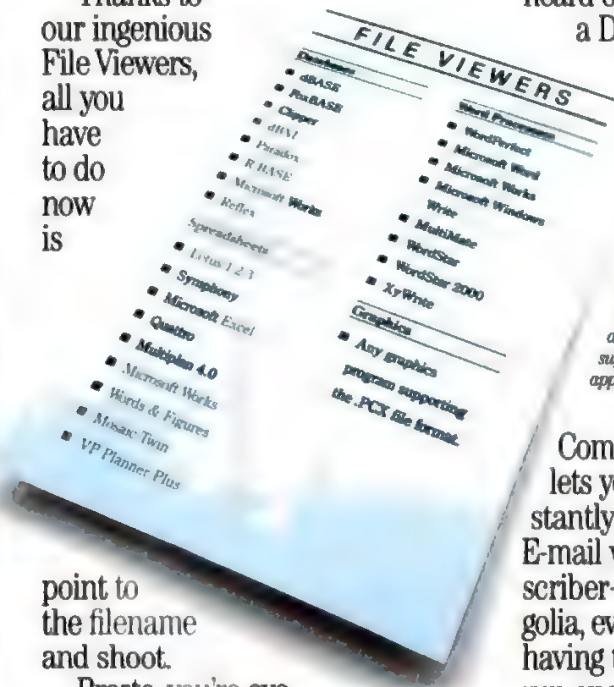
point to the filename and shoot.

Presto, you're eyeballing your data.

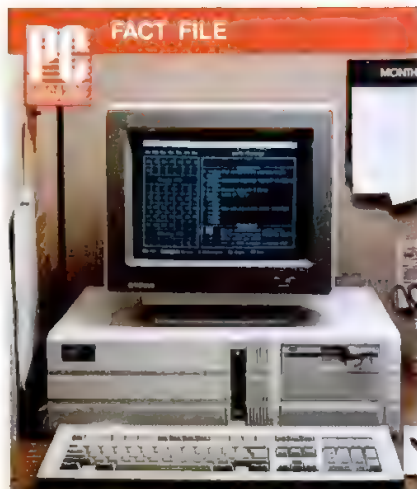
Fire again and you've launched the application.

In fact, a couple of keystrokes—or mousestrokes, if you prefer—is all it takes to perform the full range of file management functions.

Or, for that matter, to call up a



386SX MACHINES



IDS PC-386SX-40

Intelligent Data Systems Inc., 6319 E. Alondra Blvd., Paramount, CA 90723; (800) 325-2455, (213) 633-5504.

List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, one parallel port, two serial ports, one game port, utilities, GW-BASIC, DOS 3.3, \$1,099; with 43MB hard disk, VGA monitor, \$1,995. 1MB RAM upgrade, \$200.

In Short: The IDS PC-386SX-40 comes in a full-sized desktop case and has room for five half-height drives and eight expansion cards, but surprisingly, the memory maximum is only 4MB. Sold both by dealers and by IDS's direct sales force, the PC-386SX-40 is aggressively priced.

CIRCLE 424 ON READER SERVICE CARD

TEAC 1.2MB 5.25-inch floppy disk drive. The video system consists of a 16-bit ATI VGA 640 display card and a Tatung CM1496 color VGA monitor. The COPAM Electronics 101-key keyboard that comes with the unit has a cable that stretches out to a full 80 inches.

None of these components yielded outstanding scores on our benchmark tests. The machine garnered middle-of-the-road ratings in processor and disk tests but did rather poorly in the video BIOS benchmark tests.

You can buy your machine through dealers or from IDS's direct sales force (the latter services corporate accounts only). A one-year parts-and-labor warranty is standard, but you'll have to ship the machine back to the manufacturer unless you make separate arrangements with a dealer or purchase a service contract from a third-party supplier.

The PC-386SX-40 gets real points for offering a substantial amount of options at low prices. If you want a large case with plenty of room for drives and 16-bit expansion cards, this IDS system deserves careful consideration.

LANIER BUSINESS SYSTEMS

Lanier 386/16 SX

by Winn L. Rosch



In the staid world of PCs, the Lanier 386/16 SX is a little swinger. That is, a card cage holding all its expansion boards swings out the back of the small-footprint case, giving the 5- by 18- by 12-inch (HWD) machine the cleanest design around—at least as far as the rear panel is concerned.

The \$3,895 system (with 4MB RAM, color VGA, and 42MB hard disk) uses a passive backplane architecture rather than a true system board. Not only is the entire circuitry of the Lanier 386/16 SX system board crammed onto one expansion card, but all the interfaces (two floppy disk drives, IDE for up to two hard disks, two serial ports, and one parallel port, but no



386SX COMPUTERS: SUMMARY OF FEATURES

(Products listed in alphabetical order by company)

	Multimicro Inc. MMI16SX	NCR Corp. NCR PC386sx	NEC Information Systems NEC PowerMate SX Plus	Pan United Corp. Micro Lab 386/SX	PC Designs Inc. PC Designs GV386SX	Polywell Computers Poly 386SX	Softworks Development Corp. Citrus 386sx TS
PHYSICAL FEATURES							
Power supply (watts)	200	175.5	110	200	200	220	220
Switchable settings	125V/230V	125V/230V	125V/230V	125V/230V	125V/230V	110V/220V	125V/230V
Number of device connectors	4	4	3	4	4	4	5
Keyboard lock	Front	None	None	Front	Front	Front	Front
Case lock	Front	Front	Optional	Front	None	None	None
Power-on switch	Front	Front	Front	Side	Front	Side	Front
Reset switch	Front	None	None	Front	Front	Front	Front
Hard disk options	90MB, 150MB, 300MB (ESDI); 90MB (SCSI)	40MB, 100MB (ST-506)	42MB (ST-506); 100MB, 140MB (ESDI)	40MB, 80MB (ST-506); 145MB, 300MB (ESDI)	44MB (ST-506); 90MB (ESDI)	80MB (ST-506); 150MB, 300MB, 600MB (ESDI)	40MB (IDE); 40MB, 60MB (MFM); 160MB, 320MB, 680MB (ESDI)
SUPPORT							
Warranty	1 year	1 year	1 year	1 year	1 year	5 years (less on some parts)	1 year
Service	Ship to manufacturer	Return to dealer	Return to dealer	Return to dealer	On-site	Ship to manufacturer	On-site
FCC certification	A	B	B	B	A	A	A

■ —Editor's Choice ■ —Yes □ —No

COMPUTERS 386SX MACHINES

video output) fit its confines as well.

The backplane makes the 386/16 SX a machine for either the indecisive or for those planning a future upgrade. You can slide a variety of CPUs, including a 25-MHz 80386, into the same chassis. To ease the transition, Lanier offers a trade-in program that allows 40-percent credit for your old CPU board when you exchange it for a new one within the first year of ownership. (Lanier also offers a full-size chassis for its CPUs.)

Inside the heavy plastic case of the 386/16 SX are several steel subassemblies connected with a clutter of cables. A 100-watt open-frame power supply hides under a metal plateau that supports two 3.5-inch floppy disk drives; a third internal 3.5-inch floppy disk drive device can mount vertically, left of the twin bays. A huge fan behind the disk drives wafts a cooling breeze across both the power supply and the card cage.

One of the system's six expansion slots features two 8-bit connectors, letting you install two half-length XT boards tête-à-tête or one full-length board. The rest are 16-bit slots, with one irrevocably occupied by the CPU. All slots accept their expansion cards horizontally.

AESTHETICS ASIDE

The swinging card cage allows access to expansion board connectors. Once closed, you see only a blank back panel with cables trailing from a neat slot instead of the usual waterfall of wires.

Although aesthetically pleasing, the arrangement is not quite perfect—for example, the ferrite lump in the keyboard cable wanted to wedge itself into the cable access slot. Moreover, the wobbly pivot hardware needs reinforcing.

Installing expansion boards is also inconvenient because you've got to remove two protective shrouds—the top of the cabinet itself and the lid from the card cage—to squeeze a board in. This is a machine for people who plan to set it up once and not experiment with expansion options later.

Once running, however, the Lanier does a commendable processing job. Add that good performance to the clever design of the 386/16 SX and the long history of Lanier (founded in 1936; has been building word processors since 1978 and PCs since 1984), and you have a welcome desktop data processing companion.



Lanier 386/16 SX

Lanier Business Systems, 2310 Park Lake Dr., Atlanta, GA 30345; (800) 727-8001, (404) 270-2000.

List Price: With 4MB RAM, 1.44MB 3.5-inch floppy disk drive, one parallel and two serial ports, diagnostics software, \$2,195; with 42MB hard disk, VGA monitor, \$3,895. 1MB RAM upgrade, \$695; DOS 3.3, \$150.

In Short: A small-footprint computer with a unique, swinging card cage. The system uses passive backplane technology, putting the CPU on an expansion card to allow for easy upgrades.

CIRCLE 425 ON READER SERVICE CARD

Sunburst Systems Inc. Sunburst 386SX-16	Tandon Computer Corp. Tandon PAC 386sx	Tandy Corp. Tandy 4000 SX	Tangent Computer Inc. Tangent 316SX	Tatung Company of America Inc. Tatung TCS-6800S	UTI Computers UTI 386 SX	Wang Laboratories Inc. Wang PC 350/16S	Zeos International Zeos 386SX-16
200	126	200	285	180	220	145	200
125V/230V	None	125V/230V	125V/230V	230V/125V	125V/230V	125V/230V	110V/220V
3	4	4	4	6	4	3	4
Front	None	Front	Front	Front	Front	Front	Front
Front	None	Front	None	None	None	Front	Front
Side	Front	Front	Side	Front	Side	Front	Front
Front	Front	Front	Front	Front	Front	None	Front
80MB (ST-506); 80MB, 150MB, 320MB (ESDI)	30MB, 40MB (DataPacs)	40MB, 80MB (IDE); 40MB, 80MB, 170MB, 344MB (SCSI)	42MB, 67MB (ST-506); 155MB, 330MB, 650MB (ESDI); 82MB (SCSI)	40MB, 80MB (MFM); 90MB, 160MB, 360MB (ESDI); 330MB (SCSI)	65MB, 80MB (ST-506); 110MB, 150MB, 330MB (ESDI); 80MB (SCSI)	100MB (MFM)	160MB, 337MB (ESDI); 80MB, 344MB, 874MB (SCSI)
2 years	1 year	1 year	1 year	1 year	1 year	1 year	1 year
Ship to manufacturer	Return to dealer	Return to dealer	On-site	On-site	Return to dealer	Return to dealer	On-site
A	B	B	A	B	A	B	B

ENDS



BENCHMARK TESTS: 386SX-BASED PCs

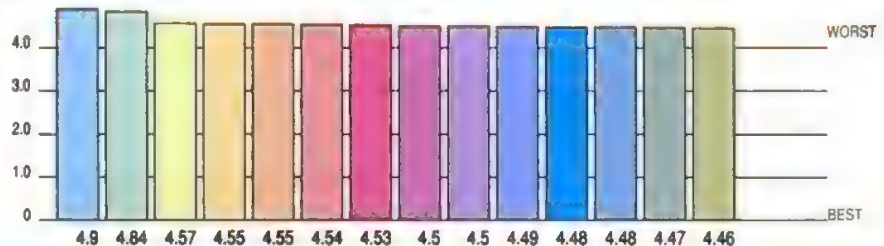
No clear winners emerge in this roundup of 31 new 386SX machines. The Zeos, AST, and Gateway 2000 machines are fastest on PC Labs' processor and memory tests, while Softworks' Citus 386sx TS has the fastest hard

disk. The Gateway 2000, Epson, and Pan United (Micro Lab) machines come closest to matching the Compaq Deskpro 386S in consistently fast video performance; the Acer, AST, and Zeos are closely tied runners-up.

PROCESSOR AND MEMORY BENCHMARK TESTS

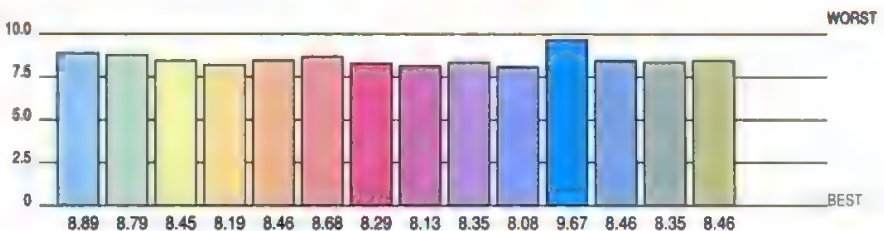
80386 Instruction Mix

The **80386 Instruction Mix** benchmark test times a series of tasks specific to the 80386 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.



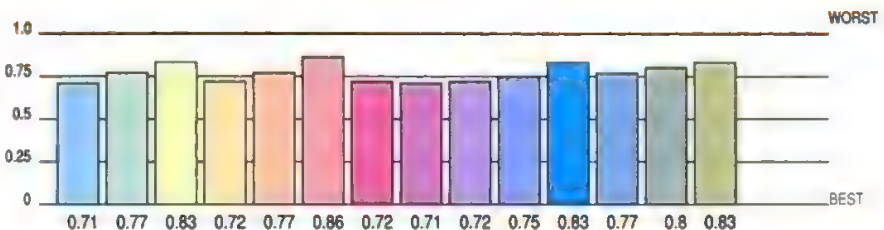
Floating-Point Calculation Without Coprocessor

The **Floating-Point Calculation Without Coprocessor** benchmark test sets up a floating-point emulation program in RAM and then exercises the processor and tests RAM access speeds during floating-point calculations.



Conventional Memory

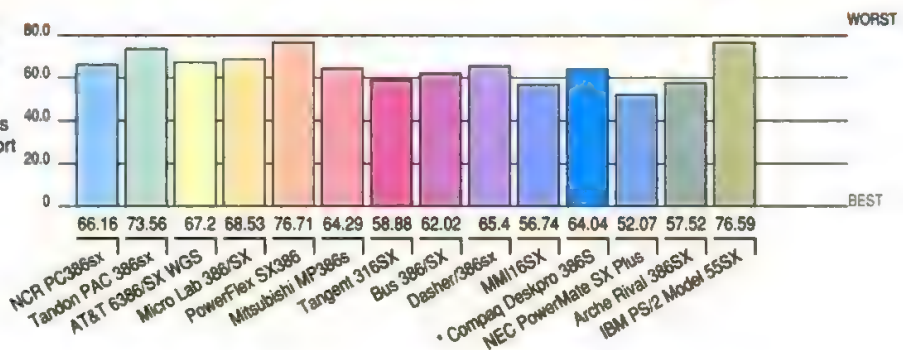
The **Conventional Memory** benchmark test measures the read/write speed of the first 640K of memory. Slower relative times can indicate the presence of memory wait states or memory chips rated at slower access speeds.



DISK BENCHMARK TESTS

DOS File Access (Small Records)

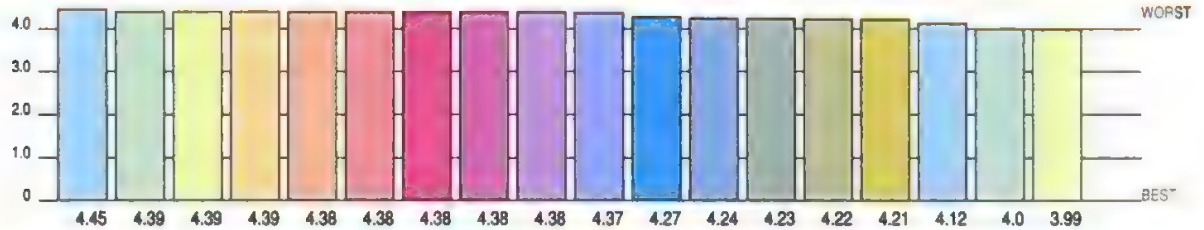
The **DOS File Access (Small Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data.



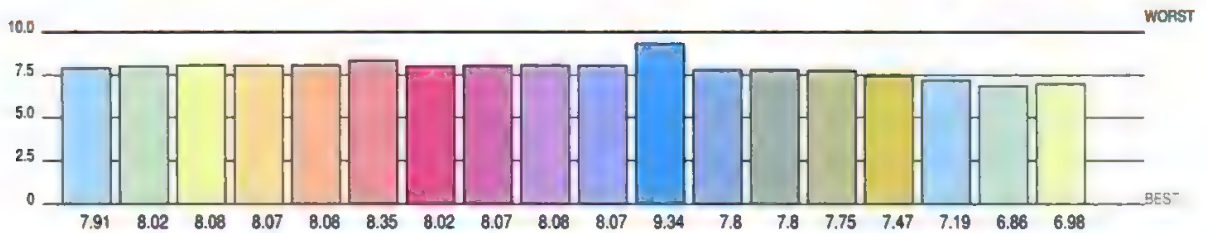
* Reported for comparison

COMPUTERS 386SX MACHINES

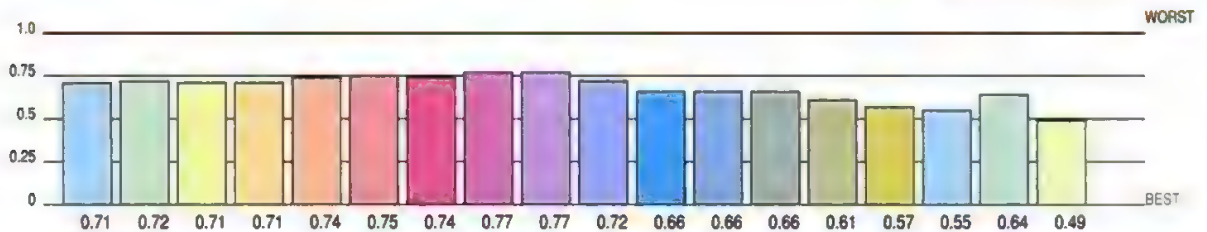
Elapsed Time (seconds)



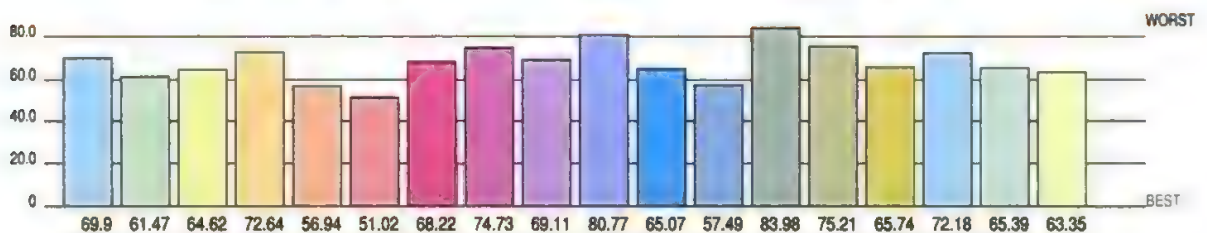
Elapsed Time (seconds)



Elapsed Time (seconds)



Elapsed Time (seconds)



Acer 1100/SX
IDS PC-386SX-40
Mitac MPC 2386
Poly 386SX
PC Designs GV386SX
Powerlite 386SX
Tandy 4000 SX
UTI 386 SX
Wang PC 350/16S
Lanier 386/16 SX
Tatung TCS-8800S
Citus 386SX TS
Austin 386SX
Sunburst 386SX-16
Epson Equity 386SX
386SX Gateway 2000 Multiperformer
AST Premium 386SX/16
Zaos 386SX-16

CONTINUES



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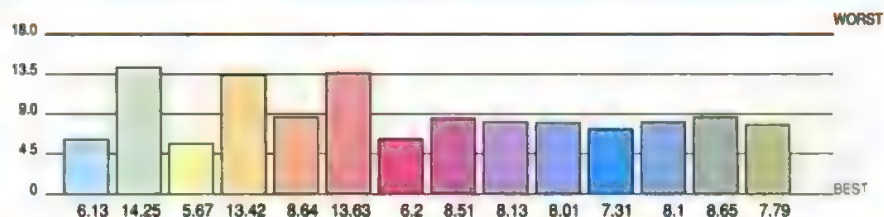
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BENCHMARK TESTS: 386SX-BASED PCs

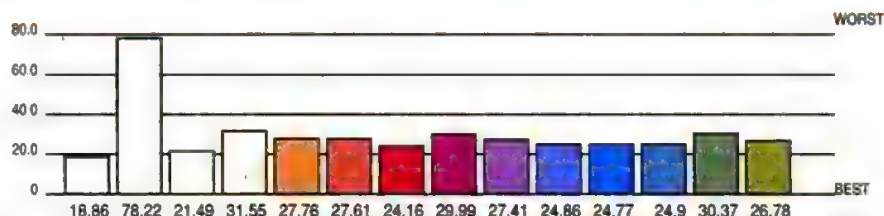
DOS File Access (Large Records)

The **DOS File Access (Large Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are loaded.



BIOS Disk Seek

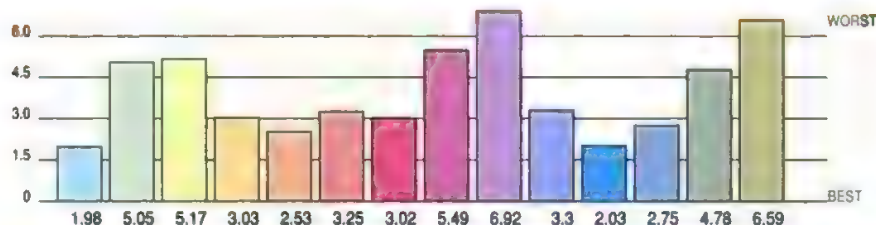
The **BIOS Disk Seek** benchmark test measures mechanical track-to-track disk drive access times. Fast times are helpful with programs such as databases, which often store and must later find data in many separate places on a drive.



VIDEO BENCHMARK TESTS

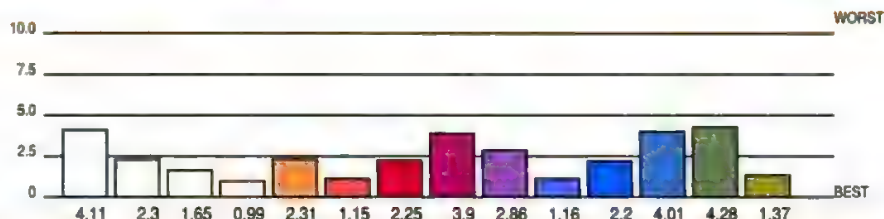
Direct to Screen

The **Direct to Screen** benchmark test indicates the speed of the video adapter memory. Good scores indicate that information can get to the screen quickly, particularly for programs that avoid the computer's BIOS and go directly to the screen.



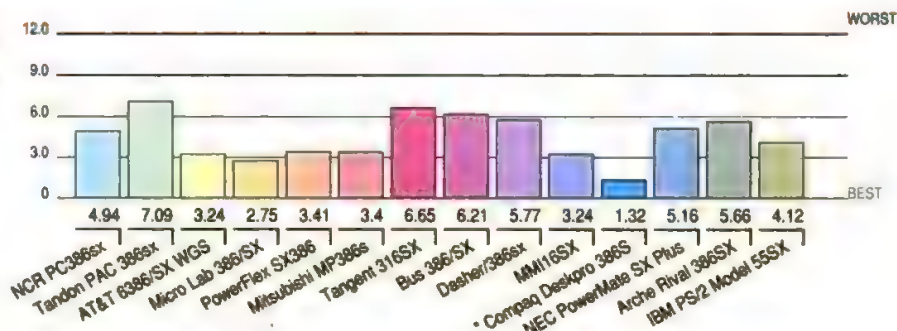
Video BIOS Routine Without Scrolling

The **Video BIOS Routine Without Scrolling** benchmark test measures how quickly the BIOS on the video adapter writes text data to the screen. Fast video writing helps with programs that show full or partial screens of data without scrolling the screen.



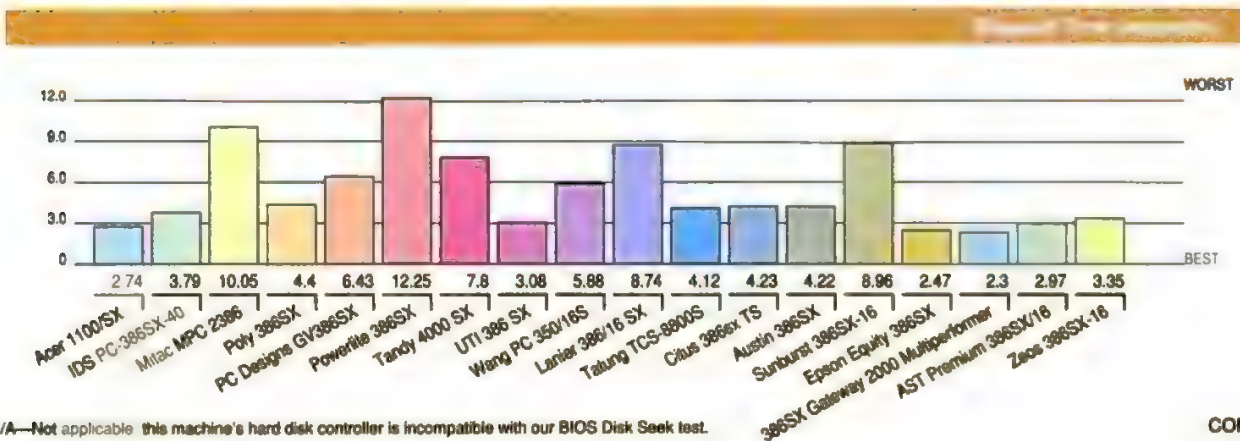
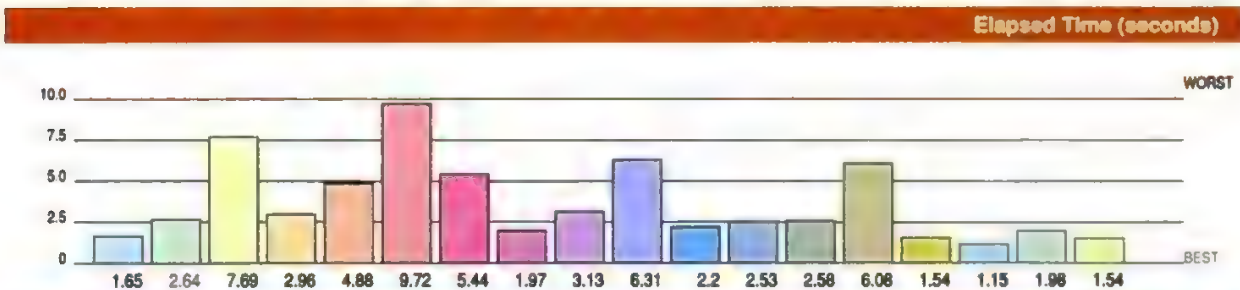
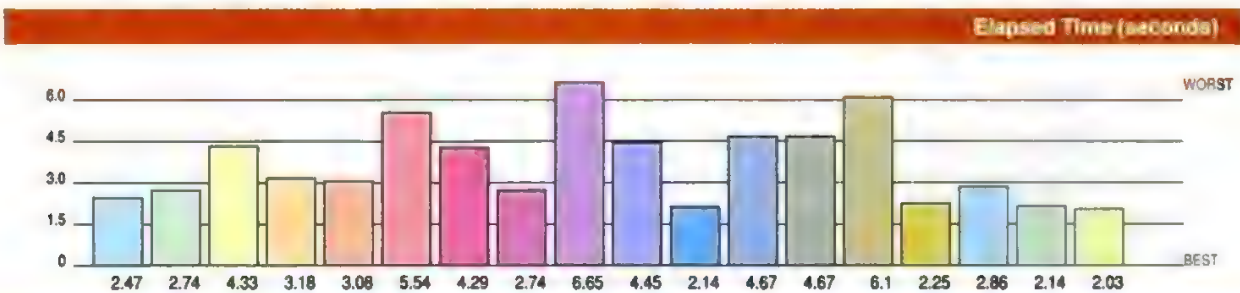
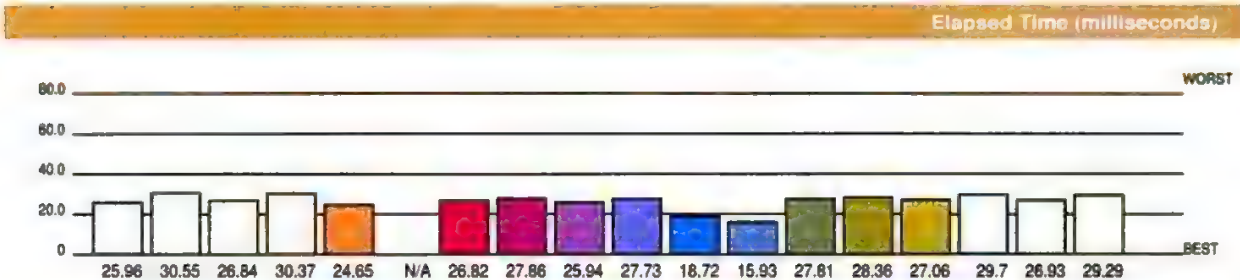
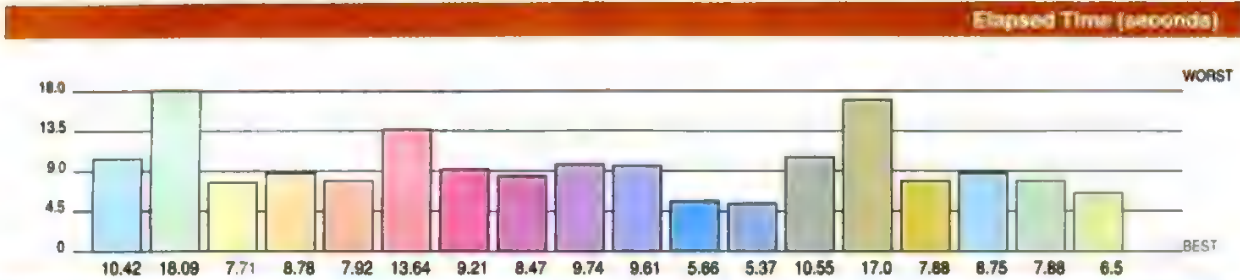
Video BIOS Routine with Scrolling

The **Video BIOS Routine with Scrolling** benchmark test measures how fast the video adapter can scroll the screen, moving the display up one line at a time. Good performance is helpful for scrolling through word processing or spreadsheet files.



* Reported for comparison

COMPUTERS 386SX MACHINES



N/A—Not applicable this machine's hard disk controller is incompatible with our BIOS Disk Seek test.

CONTINUES



PROCESSOR, MEMORY, AND DISK BENCHMARK TESTS: COMPOSITE VIEW

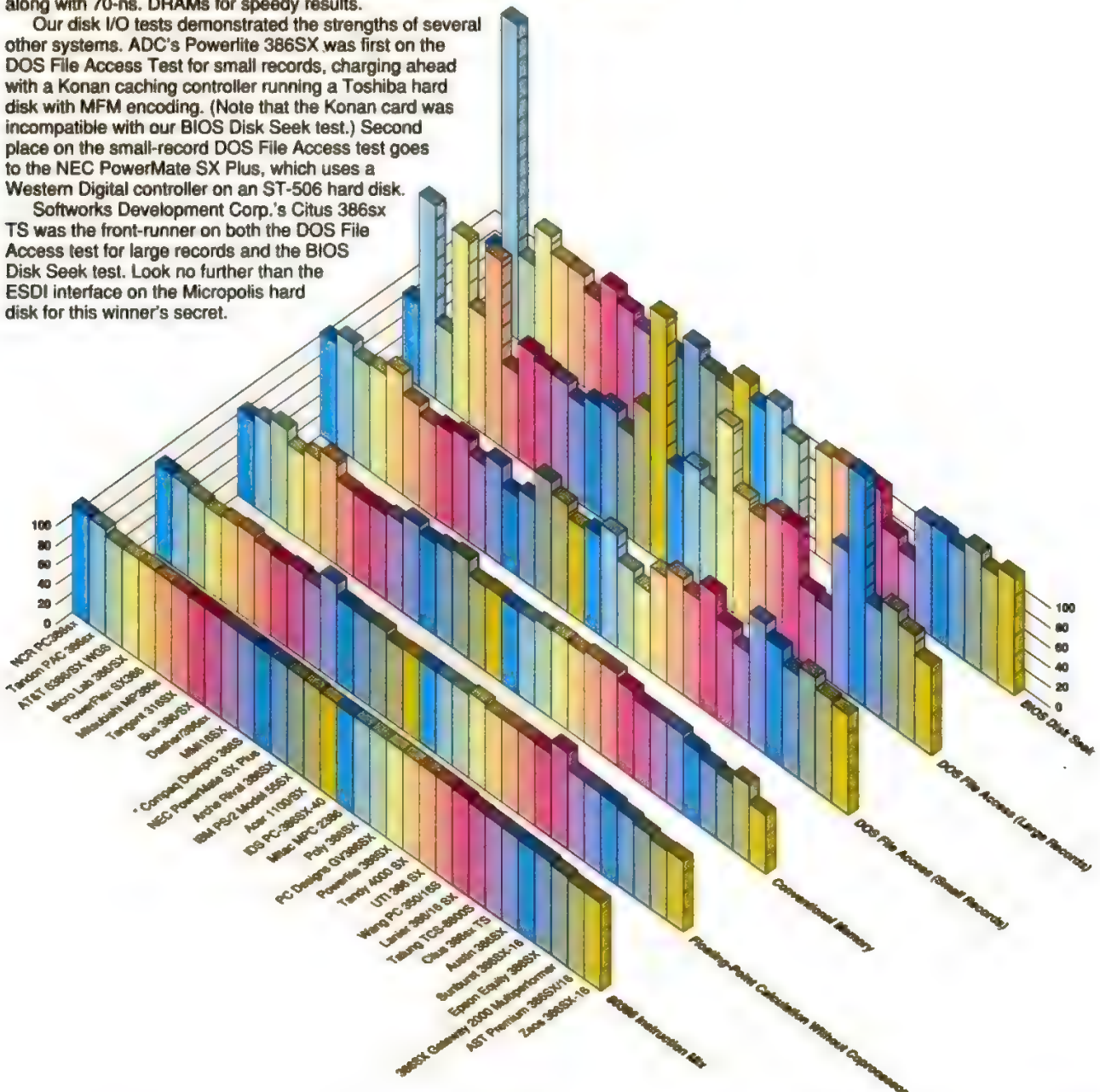
Performance varied widely on most of these benchmark tests, but there were a few consistent leaders. One was the Zeos 386SX-16, which placed first on the 80386 Instruction Mix and Conventional Memory tests and second on the Floating-Point Calculation Without Coprocessor test. Zero-wait-state operation and 60-nanosecond memory contributed to the machine's fast times on these tests.

Another top processor/memory performer was the AST Premium 386SX/16. Within its memory cache, AST uses 16K of 45-ns. SRAM. The 386SX Gateway 2000 Multiperformer likewise showed processing power, coming in third in the Instruction Mix and Floating-Point tests and second on the Conventional Memory test. Gateway utilizes both interleaved and page-mode memory, depending upon the installed RAM size, along with 70-ns. DRAMs for speedy results.

Our disk I/O tests demonstrated the strengths of several other systems. ADC's Powerlite 386SX was first on the DOS File Access Test for small records, charging ahead with a Konan caching controller running a Toshiba hard disk with MFM encoding. (Note that the Konan card was incompatible with our BIOS Disk Seek test.) Second place on the small-record DOS File Access test goes to the NEC PowerMate SX Plus, which uses a Western Digital controller on an ST-506 hard disk.

Softworks Development Corp.'s Citus 386sx TS was the front-runner on both the DOS File Access test for large records and the BIOS Disk Seek test. Look no further than the ESDI interface on the Micropolis hard disk for this winner's secret.

Relative Times
(Compaq Deskpro 386S = 100)



* Reported for comparison

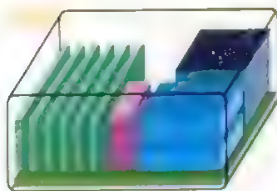
CONTINUES

COMPUTERS 386SX MACHINES

**MITSUBISHI ELECTRONICS
AMERICA INC.**

Mitsubishi MP386s

By Bruce Brown



Many clone companies fill their PCs with a variety of interchangeable standard parts. Mitsubishi differs from the norm by using

nearly all home-grown components in its MP386s, a smallish desktop machine measuring just 6.1 by 15 by 15 inches (HWD).

However, Mitsubishi's self-sufficient approach doesn't necessarily mean dollar savings for the end user. A system with 2MB RAM, a 42MB hard disk, 1.2MB 5.25-inch floppy disk drive, VGA card and color monitor, DOS 3.3 and *Super PC-Kwik* costs a whopping \$5,195.

PROPRIETARY COMPONENTS

An FCC Class B machine, the MP386s sports a clean-looking front panel with a small door that covers the system reset and DIP switches, as well as the speaker vol-

ume control. The keylock and power switch are also on the case front, along with the power and hard disk access lights.

Mitsubishi's motherboard comes with 2MB of 100-nanosecond, 1-megabit SIMMs. The memory chips are from Mitsubishi. You can buy a \$1,195 daughterboard that comes with 2MB RAM and has room for two additional 2MB sets (available for \$995 each). The proprietary motherboard incorporates the Phoenix ROM BIOS Version 3.1, which lets you shadow system and video ROM into RAM for better performance.

There's adequate room for add-in boards: you get six 16-bit slots, four of which were free in the test system. Storage device accommodations are a bit skimpy,

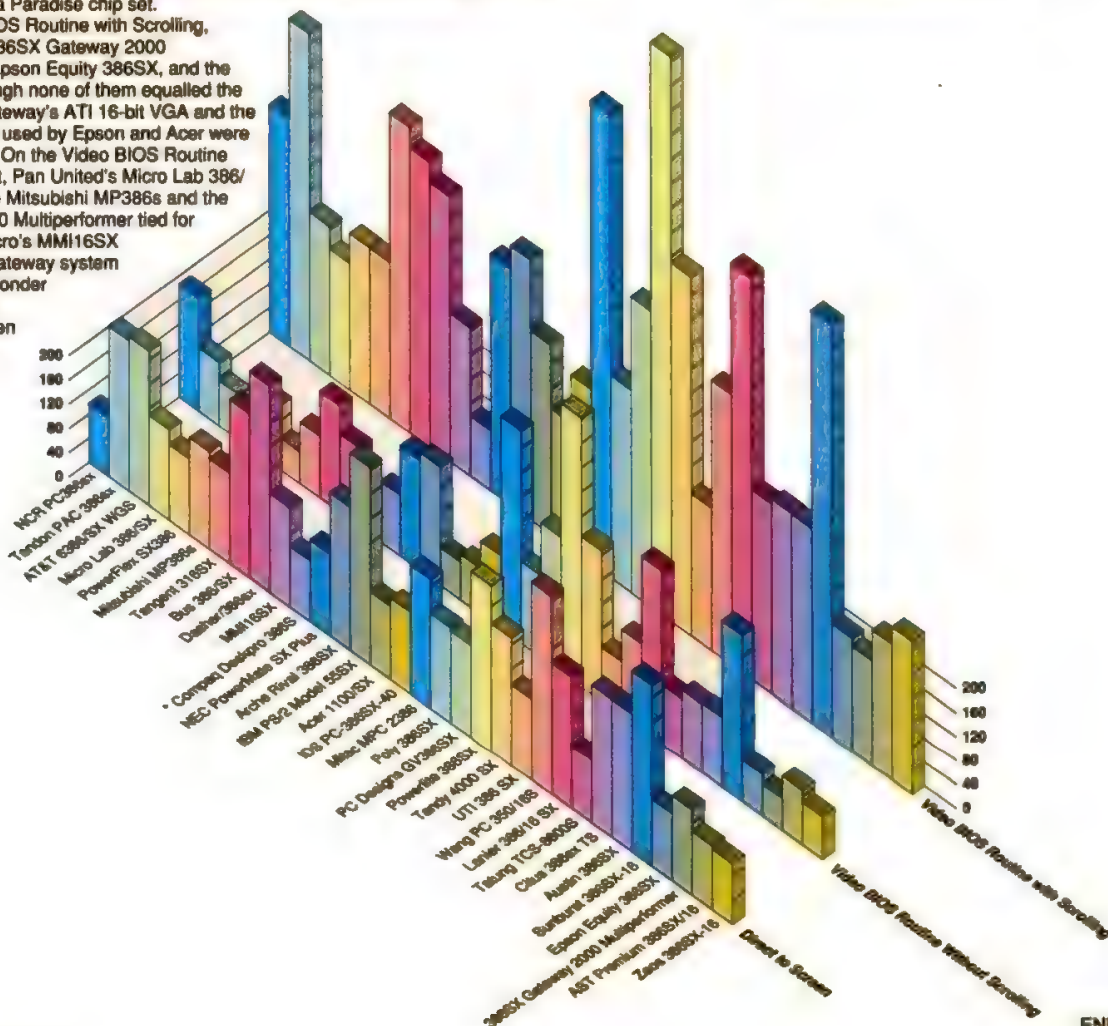


VIDEO BENCHMARK TESTS: COMPOSITE VIEW

The NCR PC386sx's 16-bit Paradise VGA board won it top honors in the Direct to Screen test; its solid disk and video scores help to counter its slower processor and memory test results. Tying with the Compaq Deskpro 386S (our reference standard for these tests), the Zeos 386SX-16 was second on the Direct to Screen test, using a 16-bit MaxLogic VGA with a Paradise chip set.

For the Video BIOS Routine with Scrolling, honors went to the 386SX Gateway 2000 Multiperformer, the Epson Equity 386SX, and the Acer 1100/SX, although none of them equalled the Compaq's score. Gateway's ATI 16-bit VGA and the Paradise 16-bit VGA used by Epson and Acer were the key factors here. On the Video BIOS Routine Without Scrolling test, Pan United's Micro Lab 386/SX captured first, the Mitsubishi MP386s and the 386SX Gateway 2000 Multiperformer tied for second, and MultiMicro's MM16SX came in third. The Gateway system uses the ATI VGA Wonder card, while the other three use Video Seven 16-bit VGA boards.

Relative Times
(Compaq Deskpro 386S = 100)



* Reported for comparison

ENDS

with room for just two 5.25-inch half-height devices and one 3.5-inch floppy disk drive. Our test system came with Mitsubishi's ST-506 MFM 42MB, 28-millisecond hard disk and a DTC controller. (This is the only hard disk offered with this system.) The controller for the Mitsubishi floppy disk drive is built right into the motherboard.

Mitsubishi supplied its own Model XC1429C color VGA monitor and a 16-bit Video Seven VGA card. The only other major component without the Mitsubishi label is the Key Tronics 101-key keyboard, which sports an 80-inch cable and has its function keys across the top.

The plethora of Mitsubishi-made devices doesn't guarantee that the machine will be a screamer. In our benchmark tests, it garnered average scores on most processor and disk tests, and the worst score on the conventional memory test (probably because of the slow RAM chips).

Mitsubishi, which sells only through dealers, includes a standard one-year parts-and-labor warranty. Any other support arrangements such as on-site service are made directly through the dealer.

In the final analysis, this system is too expensive by half when it sells at list price. Unless you can get a significant dis-

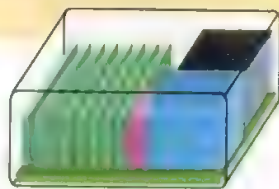
COMPUTERS 386SX MACHINES

count—many dealers take 30 percent off the list price of some systems—I can't recommend buying this acceptable but not outstanding computer.

MULTIMICRO INC.

MMI16SX

by Bruce Brown



How little can you pay for a complete 386SX system? If you're buying it from MultiMicro, the answer is \$1,495. In its base configuration, the MMI16SX includes 1MB RAM, a 30MB hard disk, a 1.2MB 5.25-inch floppy disk drive, and a monochrome video setup. DOS is an \$85 option.

The price for our standard configuration, with a 40MB hard disk, VGA color system, and DOS 3.3, jumps to \$2,299. While that price is still competitive, some other similarly configured systems sell for less.

The MMI16SX comes in a desktop design that measures 6.5 by 14 by 16.5 inches (HWD). This FCC Class A system's case includes recessed power, reset, and turbo speed buttons on the front, as well as a keyboard plug.

Even though the case is fairly small, you still get a total of eight expansion slots: three 8-bit and five 16-bit. The MMI16SX also has three 5.25-inch half-height floppy disk drive bays and one for a 3.5-inch device.

SYSTEM COMPONENTS

The motherboard, made by Precise Power Corp., uses the Chips and Technologies chip set and the AMI ROM BIOS. It takes a maximum of 8MB DRAM in either 256K or 1MB SIP modules. The system uses page-mode memory interleaving and allows both system and video ROM BIOS shadowing.

Despite these advantages, the machine showed an average performance on our processor benchmark tests, probably be-

cause of its slower, 100-nanosecond chips.

Our evaluation unit also came with a Video Seven FastWrite 16-bit VGA card and a Relisys RE9512 color VGA monitor. The combination scored especially high marks on the PC Labs Direct to Screen benchmark test.

The Toshiba 42MB MFM hard disk in the test system, rated at 24-milliseconds, is run by a combination floppy/hard disk Western Digital controller. The standard Key Tronics 101-key keyboard has a 72-inch cable.

MultiMicro's warranty covers parts and labor for one year, but at present you must ship the machine back to the manufacturer for service. According to the vendor, the company is negotiating for an optional on-site service contract that may be available by now.

MultiMicro's under-\$1,500 base price makes it possible for users to get a 386SX system for only a little more than the cost of an AT or XT. While that's significant for users on a tight budget, there's really nothing else that makes the MultiMicro stand out. Like many of the other systems reviewed here, it will serve the needs of those who want their machines to have industry-standard components and yield at least mid-level performance.



Mitsubishi MP386e

Mitsubishi Electronics America Inc., 991 Knox St., Torrance, CA 90502; (213) 527-7655.
List Price: With 2MB RAM, 1.2MB 5.25-inch floppy disk drive, one parallel and two serial ports, utilities, DOS 3.3, \$2,995; with 42MB hard disk, VGA monitor, \$5,195.

In Short: Mitsubishi's MP386e comes in a small, clean-looking case, with most of the components—from the power supply to memory chips—bearing the Mitsubishi label. Look hard for discounts, since this machine bears unfortunately high list prices.

CIRCLE 426 ON READER SERVICE CARD



MMI16SX

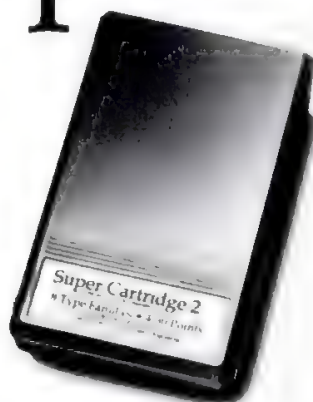
MultiMicro Inc., 582 Folsom St., San Francisco, CA 94105; (415) 979-0140.

List Price: With 1MB RAM, 30MB hard disk, 1.2MB 5.25-inch floppy disk drive, monochrome monitor, one parallel port, utilities, \$1,495; with 42MB hard disk, VGA monitor, DOS 3.3, \$2,299. 1MB RAM upgrade, \$200.

In Short: The MMI16SX in its base configuration may be the least expensive 386SX currently available. The machine has good expandability and acceptable performance. Bargain hunters should take a close look.

CIRCLE 427 ON READER SERVICE CARD

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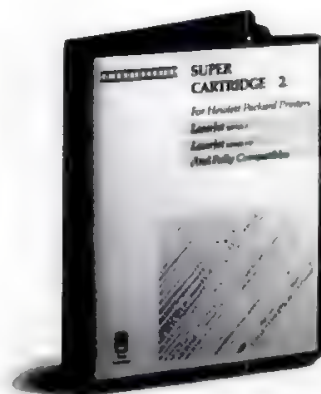
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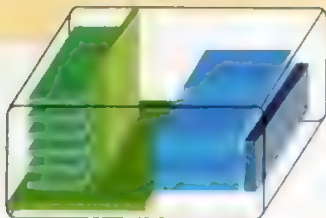


IQ ENGINEERING

NCR CORP.

NCR PC386sx

by Henry Fersko-Weiss



One of the most appealing aspects of NCR's PC386sx is the company's imprint on all the essential components: it makes everything from the monitor and keyboard to the motherboard. Since NCR has such a good reputation for reliable construction, this is especially important.

This characteristic becomes significant when you consider the cost of the machine. The PC386sx with 1MB RAM, 40MB hard disk, VGA card and monitor with 800 by 600 resolution, and DOS 4.01, costs \$5,039. That's considerably higher than the average price for an equivalently configured 386SX computer.

The design of the PC386sx is quite thoughtful. Because it's only 15 inches wide by 16.75 inches deep, it doesn't take up much room on your desk. In addition, it stands only 5.5 inches high. The four expansion slots have been turned sideways and mounted horizontally to fit into this trim container.

While four slots may not sound like a lot, they're all available because the parallel and serial ports, VGA adapter, and drive controller are all built into the motherboard. Even if you decide to boost the RAM from the 1MB motherboard limit to 15MB, you can do so without taking up a slot. A special piggyback board that holds up to 14MB RAM plugs into a pin connector on the motherboard.

NCR's 101-key keyboard is a winner: the keys have a smooth resistance when pressed—not the springy feel of some keyboards or the flat deadness of others.

ON THE OTHER HAND...

Some flaws do mar the system's design. For instance, the maximum of three internal drive bays is a limitation. You can have a 3.5-inch plus a 5.25-inch floppy disk drive plus a hard disk, or you can substitute an internal tape backup for one floppy disk drive, and that's it. NCR offers only 40MB and 100MB hard disk options, with

386SX MACHINES

the 100MB MFM drive going for a whopping \$2,395.

Additionally, a number of system functions must be enabled by DIP switches on the motherboard. The ports, the memory size, and display characteristics are all controlled from the switch blocks, as is setting the processor speed to 8 or 16 MHz. Keep a screwdriver handy.

The performance of the PC386sx is mixed. The system came in last on the instruction mix test and nearly last on the floating-point calculation. It performed somewhat better on the conventional memory test, scored middle-of-the-road on the small-record file access test, and sparkled on the large-record DOS file access, BIOS disk seek, and direct-to-screen video benchmark tests.

NCR supplies on-site service for a full year if you purchase the machine direct from the company. Word of mouth on the company's support is that its service people are good at what they do and responsive to your needs. Systems bought from dealers must be returned there for service.

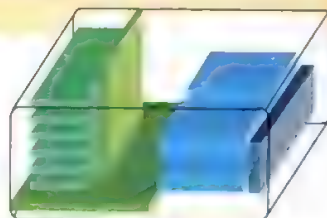
NCR has done a good job in designing

this system, stocking it with its own components almost from the ground up. However, the performance does not exactly match the thoughtful design, and you may want to ask yourself if a well-built but only moderately fast system is worth such a large chunk of your budget.

NEC INFORMATION SYSTEMS

NEC PowerMate SX Plus

by Edward Mendelson



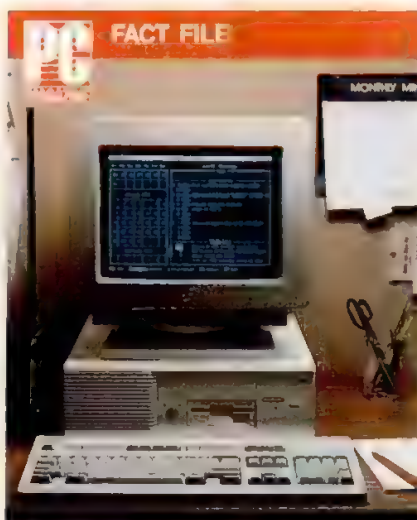
When you aren't using NEC's PowerMate SX Plus, you might want to put it into a display case. This small-footprint machine, priced at \$2,699 in a minimal no-hard-disk configuration, is one of the most precisely built and luxuriously finished computers that ever graced a test bench in PC Labs.

The elegant surface-mount technology of its motherboard; the complex interlocking design of the dedicated boards bearing the CPU, floppy disk drive controller, and optional high-speed memory; and the exact detailing and finish on all its parts make this a computer to admire as well as to use. Even the Enhanced-style keyboard, with its light but clicky feel, is a contender for the title of best keyboard.

NEC's basic model, with 2MB RAM on the motherboard, also comes with 800 by 600 enhanced VGA, a floppy disk drive controller, plus serial, parallel, and PS/2 mouse ports all built onto the motherboard or dedicated daughterboards. You also get a 1.2MB 5.25-inch floppy disk drive, DOS 3.3, and *Microsoft Windows/386*.

An empty half-height drive bay on the front panel can take an optional 1.44MB 3.5-inch floppy disk drive. A vented vertical panel next to the drive bays seems like it was designed to hold another 3.5-inch floppy disk drive, but there's no empty space behind it.

To get any serious work done with the PowerMate, you should choose a model with a hard disk controller and drive. You can get a \$3,599 unit with a 42MB ST-506



NCR PC386sx

NCR Corp., 1700 S. Patterson Blvd., Dayton, OH 45479; (800) 544-3333.

List Price: With 1MB RAM, a 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, one parallel port and two serial ports, DOS 3.3, \$3,290; with 40MB hard disk, VGA monitor, DOS 4.01, \$5,039

In Short: The PC386sx is a small-footprint machine with four open slots. It's manufactured almost completely by NCR from top to bottom, and that spells reliability. The system, which yields mixed performance on the PC Labs benchmark tests, has limited hard disk options and suffers from a very steep price.

CIRCLE 428 ON READER SERVICE CARD



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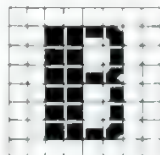
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Howard A. Minnick, CMSgt, USAF
Superintendent, Communications—Computer Operations

"I like the machine. I am rather picky but no one ever lost their cool. Courteous and polite all the way. Would I do it again? You bet."

Ralph Kissel, Senior Electronics Engineer

"We've standardized on Gateway 2000 systems in our department. Your prompt service and technical support has kept our sales operation running better than ever. Based on the quality and performance of your systems, I would strongly recommend them to other corporations."

Elizabeth Coyman, Director of Inside Sales
BYTE/McGraw-Hill

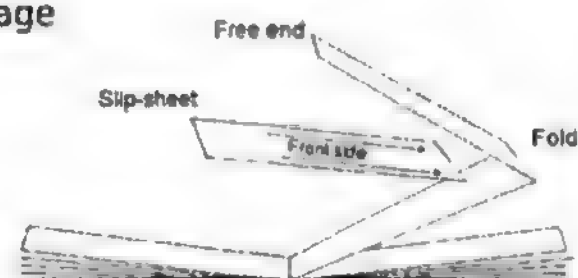


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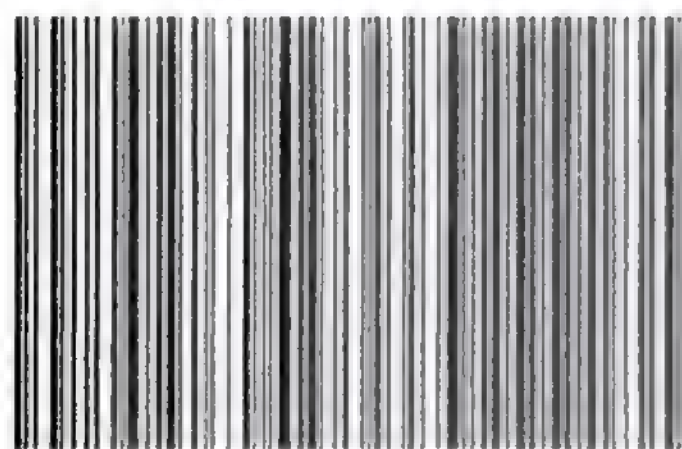
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4. Close the page and slip-sheet



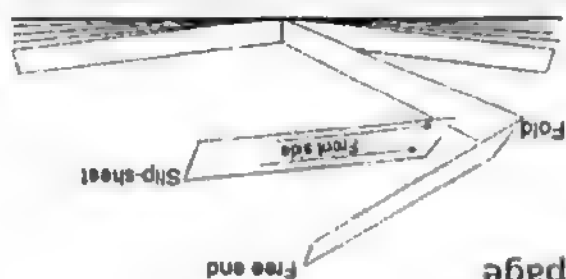
Foldout slip-sheet



Inverted Foldout slip-sheet

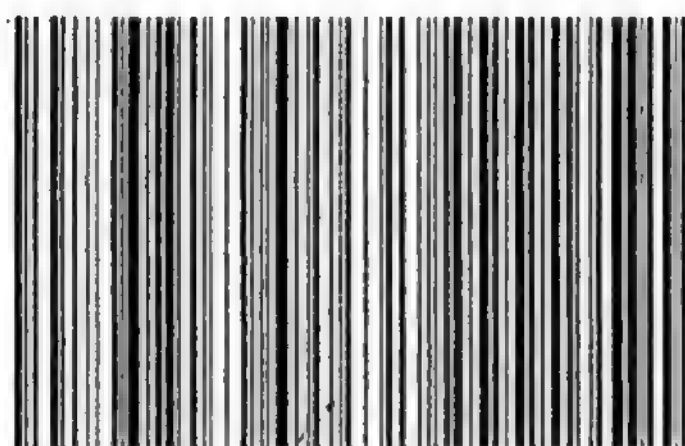
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GbsSlipBack-0018

Back

1. Follow instructions on the other side



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- 1.2 Meg 5¼" Drive
- 1.44 Meg 3.5" Drive
- 65 Meg 28ms RLL Drive
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- 14" 1024 x 768 Color Monitor
- 1 Parallel & 2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.01

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- 2 Megs RAM
- 1.2 Meg 5¼" Drive
- 1.44 Meg 3.5" Drive
- 65 Meg 28ms RLL Drive
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- 14" 1024 x 768 Color Monitor
- 1 Parallel & 2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.01

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- 1.2 Meg 5¼" Drive
- 1.44 Meg 3.5" Drive
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- 14" 1024 x 768 Color Monitor
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- 101 Key Keyboard
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- 16 Bit VGA with 512K
- 14" 1024 x 768 Color Monitor
- 1 Parallel & 2 Serial Ports
- 101 Key Keyboard
- MS DOS 3.3 or 4.01

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disk in the internal 3.5-inch bay (as in the tested machine), or if you prefer ESDI hard disks, a \$4,599 model with an internal 100MB hard disk or \$4,799 system with a 140MB drive in the second half-height bay in the front panel. (You can combine the two ESDI drive options, but you can't combine the ST-506 disk with either of the ESDI drives.) You can also put a 40MB or 150MB tape backup drive into the second floppy disk drive bay. Keep in mind, though, that the machine can take only three disk devices total.

DESIGN AND PERFORMANCE

The four 16-bit expansion slots (one containing the hard disk controller) are on a backplane that attaches vertically to the motherboard. The floppy disk drive controller is part of that backplane; a card with the 386SX and socket for a 387SX sits in front of it, and a slot for an optional memory card is nestled beside it. The memory slot can take a 1MB board expandable to 2MB or a 4MB board expandable to 8MB. Additional memory can be added in one of the ordinary expansion slots.

One minor inconvenience is that you have to remove nine screws to open the



NEC PowerMate SX Plus

NEC Information Systems, 1414 Massachusetts Ave., Boxborough, MA 01719; (800) NEC-INFO, (508) 264-8000

List Price: With 2MB RAM, 1.2MB 5.25-inch floppy disk drive, one parallel port, one serial port, one mouse port, DOS 3.3, Microsoft Windows 386, \$2,699; with 42MB hard disk, \$3,599; with PowerMate Super VGA monitor, \$4,398. 1MB RAM upgrade, \$595.

In Short: NEC's PowerMate SX Plus is a superbly well-crafted small-footprint design with an excellent keyboard and good performance, but limited expansion capabilities compared with larger desktop models. This is an example of the computer as a work of art.

CIRCLE 429 ON READER SERVICE CARD

COMPUTER 386SX MACHINES

case. Another is that setup requires a floppy disk even though the setup program itself is elegant and packed with options, including a ROM-based password and optional system BIOS and video BIOS shadowing.

As for speed, the PowerMate SX pulled generally average scores on our benchmark tests, although it stood out in the small-records file access test. NEC's latest 386SX makes up for its limited disk expansion possibilities with its compact size and elegant construction. It isn't cheap, but it's one of the few computers that may be worth owning as a work of art.

PAN UNITED CORP.

Micro Lab 386/SX

by Winn L. Rosch



Works up to abilities, A; gets along well with others, A; neatness and appearance, A; creativity, F minus. Maybe the parent of a kindergartner would dread being handed the report card Pan United would earn on its Micro Lab 386/SX, but those grades should delight anyone looking for a low-cost 386SX. The \$2,199 Micro Lab (with 1MB RAM, Award BIOS, 40MB hard disk, color VGA monitor and adapter) is remarkable in its ordinariness—but that's praise, not condemnation.

The machine's 7- by 21- by 16.5-inch (HWD) case could be that of any AT clone. Inside is a small, XT-size (8- by 13-inch) system board made by Datatech Systems but based on Intel's VLSI chip set. The chip set supports shadowing of both system and video ROM, individually selectable in 128K blocks. The two-speed 80386SX microprocessor (8 or 16 MHz, keyboard or front-panel selectable) can access up to 8MB RAM on the system board, courtesy of eight sockets that hold either 256-kilobit or 1-megabit SIMMs.

Like an AT, the Micro Lab offers eight expansion slots (two 8-bit, six 16-bit) as well as five half-height drive bays, which



Micro Lab 386/SX

Pan United Corp., 1967 Route 27, #12, Edison, NJ 08817; (800) 433-3006, (201) 985-8009.

List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, one parallel port, one serial port, one game port, \$1,195; with 40MB hard disk, VGA monitor, utilities, DOS 3.3, \$2,199. 1MB RAM upgrade, \$195.

In Short: A generic AT-size system that exhibits fine workmanship but has no truly outstanding features except its rock-bottom price tag.

CIRCLE 542 ON READER SERVICE CARD

use standard AT drive rails. In the evaluation system, a Western Digital WD1003V-MM2 floppy/hard disk drive controller, a 16-bit Video Seven FastWrite VGA adapter with 256K RAM, and a generic I/O board that carries the system's single parallel and serial port filled three slots. A 40MB Seagate ST-251-1 and 1.2MB TEAC floppy disk drive filled two of the bays. *Disk Manager* diagnostics were included to set up the hard disk.

Power comes courtesy of a 200-watt dual-voltage power supply (115 or 230 VAC switchable), with a pack of four low-cost and easily available AA-cells powering the CMOS configuration memory.

HIGH-QUALITY CONSTRUCTION

Workmanship is top-rank for a small clone-maker. All the wiring is properly bundled, and the general layout of the brightly plated chassis is neat. Unlike the machines of many other small vendors, all the indicators and controls on the front panel of the Micro Lab work properly.

The only dubious feature in the test machine was the drive activity light wiring to the disk controller: it was bundled so tight that it stressed the board. A slight tug loosened it up, however.

The Chicony keyboard proved less than pleasing. A clackety, IBM-like unit, its keys sometimes activate before the key-

click: rest your fingers on the keytops, and you may do some unexpected typing.

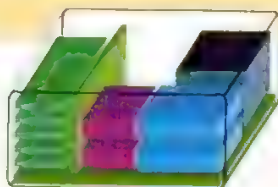
As for speed, suffice it to say that the system is not exactly a screamer, yielding mid-range or slightly slower performance on our benchmark tests.

That said, the Micro Lab 386/SX is a likable friend—bland, but obedient. And if you like your computing companions inexpensive, the price of this system certainly makes it a fine deal.

PC DESIGNS INC.

PC Designs GV386SX

by Fredric Burke



PC Designs has been turning out solid, if conservative, machines for the past several years. The company's entrant in the SX sweepstakes, the GV386SX, combines solid performance with innovative engineering: it's one of the first machines of this class to use horizontal mounting for add-in boards.

The as-tested \$3,435 price of the 3.5-by-11-by-15-inch (HWD) small-footprint machine will put a reasonable dent in your wallet. But you get a crisp Samsung VGA monitor, 4MB of 100-nanosecond DRAM, a 101-key Maxi-Switch keyboard, a 1.44MB floppy disk drive, and an Intel 80387 math coprocessor (oddly placed beneath the 44MB Toshiba hard disk drive), plus a one-year warranty, with on-site service from Memorex Telex. While the price doesn't include an operating system, you can get DOS 3.3 or 4.01 from the company for \$79 more.

You can toggle between 8- and 16-MHz bus speeds on this zero-wait-state unit. The AMI (American Micronics) motherboard will support up to 4MB of RAM, which operates in page-interleaved mode. An additional 12MB of RAM can be installed on a daughterboard. System shadow RAM can also be activated.

EXPANDABILITY ISSUES

The horizontal boards present some problems in terms of expandability. The machine includes two 8-bit and three 16-bit

slots (one of which is occupied by the VGA card); the problem is that most of these are not easily accessible. The Western Digital floppy/hard disk controller sits at the top of a T-card; you must remove it to get to the remaining 16-bit slots and the 8-bit slots on either side.

PC Designs has corrected most of these problems. The currently shipping version (not available in time for this review) features the controller at the bottom of the T-card, making the 8- and 16-bit slots easier to access. However, the user still has to take out the power supply to install anything in the 8-bit slots. PC Designs is planning to install the video controllers and the serial/parallel ports on the motherboard in order to free up slot space and increase the GV386SX's versatility.

The keyboard is slightly mushy in feel, but comfortable over the long haul. The documentation is terrific, characterized by useful technical information, good illustrations, and clear writing.

The GV386SX did well on our benchmark tests, placing in the top half overall. You'll want to pay attention to this system not only for its speed, but for its innovative design, use of industry-standard components, and on-site support.



PC Designs GV386SX

PC Designs Inc., 2500 N. Hemlock Circle, Broken Arrow, OK 74012; (800) 627-7248; (918) 251-5550

List Price: With 2MB RAM, 1.44MB floppy disk drive, one parallel and two serial ports, 40MB hard disk, \$2,239; with VGA monitor, \$3,435; DOS 3.3 or 4.1, \$79; with 90MB hard disk, \$2,899. 2MB RAM upgrade, \$330.

In Short: Despite the quirks of its new mounting system, the GV386SX stands out for its respectable speed, the quality of its engineering, and its attention to detail. Another winner from PC Designs.

CIRCLE 543 ON READER SERVICE CARD

POLYWELL COMPUTERS

Poly 386SX

by M. David Stone



The \$3,435 price tag of the Polywell Poly 386SX gets you an AT-size machine stocked with a variety of mostly industry-standard components: Orchid Technology's Privilege 386SX backplane and CPU board, the Orchid ProDesigner VGA board, a Seagate Technology 28-millisecond 42MB hard disk, a TEAC floppy disk drive, a Data Tech disk controller, a Chicony America keyboard, and Quimax Systems' DM-3114 VGA monitor.

But that price also gets you something not so industry-standard: a warranty that covers five years of labor and varying years' service on parts: four years for the graphics card; two for the monitor, backplane, and processor board; and one year for everything else. Optional on-site service is available from U.S. Net for \$300 for the first year.

A disk cache utility and expanded memory manager from Quadtel Corp. are included in the price, but DOS 3.3 or 4.01 will cost you \$65 or \$75, respectively.

The desktop chassis measures 6.7 by 21.1 by 16.5 inches (HWD); it contains a 220-watt power supply and five half-height drive bays, three of which are accessible from the front. The system board offers seven slots: two 8-bit and four 16-bit, plus the dedicated CPU slot. Two of the 16-bit slots were filled by the VGA card and disk controller, and one 8-bit slot was taken up with a New Tech I/O card.

Another slot was tied up with the additional connectors that attach to the New Tech card, ultimately leaving only two slots available. That makes the five cutouts present in addition to the slot cutouts especially welcome. According to Polywell, you can order the system with I/O connectors that don't tie up the extra slot.

ORCHID DESIGN

Orchid describes its Privilege 386SX as an active memory-backplane design, meaning that the RAM—up to 8MB—goes on

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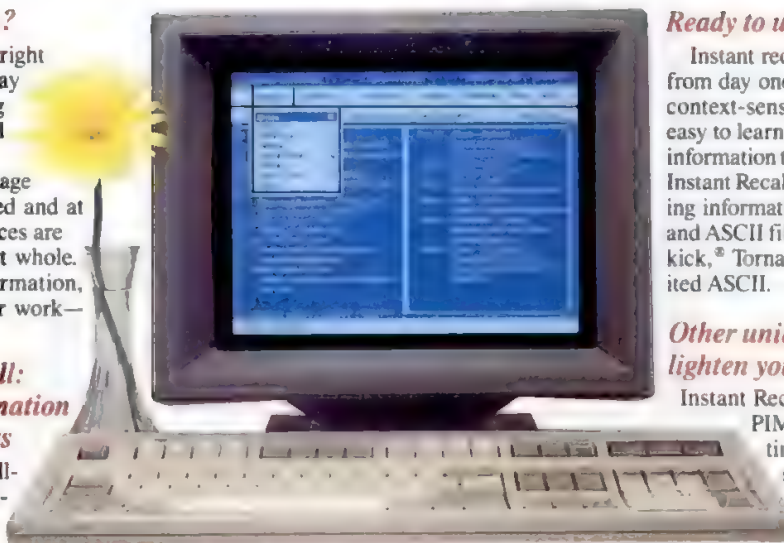
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Power: "Instant Recall delivers high-end features at a bargain price" **PC MAGAZINE**
October 17, 1989

Ease of Use: "It's Instant Recall's ease of use that really sets it off [from Agenda and Grandview]" **INFO WORLD**
October 9, 1989

Value: "One of the best values in software I've tested in some time" September 1989, Tim Bajarin, Personal Computer World



Instant Recall is always
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CIRCLE 287 ON READER SERVICE CARD

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- 40MB, 25mS hard drive (IDE interface)
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- 1.2 or 1.44MB diskette drive
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- 80387/Weitek socket
- EMS 4.0 driver
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- 386-25 From \$2295
- 386-20 From \$1630 (1MB NON-CACHE)



80386SX-16

- Intel 80386SX 16MHz CPU (Norton SI ver 4.0: 18)
- 1MB RAM standard, expandable to 8MB on motherboard
- 80387SX coprocessor socket
- Expansion slots: 6 16 bit and 2 8 bit
- 1.2 or 1.44MB diskette drive
- 200W power supply
- Monochrome card and monitor
- Additional options listed under 80386-33 system
- \$1295

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the system board. Somewhat unusually, the board can accept either DIP or SIMM chips for the first megabyte of RAM. (The review machine used SIMMs.) The CPU board includes the SX processor, the AMI BIOS, a clock/calendar, and a socket for an 80387SX math coprocessor.

Orchid says that the backplane/CPU arrangement means that you can upgrade the CPU without the cost of an expensive memory upgrade. According to Polywell, there is currently a 20-MHz 386 board available for \$500, and a 486 board is promised for the second quarter of 1990. Both of these boards will address the RAM on the backplane as 32-bit memory, although the lack of any 32-bit slots means that the system will be limited to 8MB of 32-bit RAM.

On PC Labs' benchmark tests, the Polywell system scored midrange or better on the processor tests, solidly midrange on the video tests, and somewhat on the slow side for the disk tests—all of which means that the Poly 386SX is a somewhat better-than-average performer.

If you're looking for a reasonably quick 386SX system that offers an exceptional warranty and upgrade potential, the Poly 386SX should certainly be on your list.



Poly 386SX

Polywell Computers, 61-C Airport Blvd., South San Francisco, CA 94080; (800) 999-1278; (415) 583-7222

List Price: With 1MB RAM, 1.2 MB floppy disk drive, 42MB hard disk, VGA monitor, one parallel port, two serial ports, game port, disk cache utility and expanded memory manager, DOS 3.3, \$2,150. 1MB RAM upgrade, \$200.

In Short: The Poly 386SX offers somewhat better-than-average performance and the potential for upgrading to a 386 or 486 processor board. But the eventual upgrade potential is somewhat limited by an absolute ceiling of 8MB of 32-bit RAM.

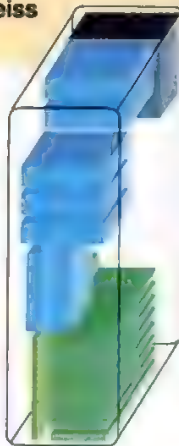
CIRCLE 544 ON READER SERVICE CARD

COMPUTERS 386SX MACHINES

SOFTWARES DEVELOPMENT CORP.

Citus 386sx TS

by Henry Fersko-Weiss



Softworks Development's Citus 386sx TS immediately gets your attention with one tantalizing feature—you can run it at 20 MHz by resetting a jumper on the motherboard. Even though Intel doesn't certify the SX chip above 16 MHz, Softworks says that operating the system at 20 MHz does not exceed the chip maker's heat specifications. The company is willing to put its money where its mouth is by fully guaranteeing the machine at the higher speed.

Even when it is running at 16 MHz, this is an outstanding computer. The Citus achieved very good scores in every processor benchmark test, boosted by fast 80-nanosecond Samsung RAM chips. It ranked among the top ten in the processor tests, helped along by the proprietary motherboard's surface-mount technology and the new, fairly small (five-chip) chip set from Via Technology.

All this speed is delivered at a very reasonable price. For \$2,930, you get a system with 1MB RAM, a 40MB hard disk, one high-density floppy disk drive, one parallel and two serial ports, VGA card and monitor, DOS 4.01, and a one-year, on-site warranty. The model we saw was in a 25.25- by 7.5- by 17-inch (HWD) tower case, but Softworks also makes the same system available (sans a few drive bays and expansion slots) in a desktop chassis for \$200 less.

INSIDE THE MACHINE

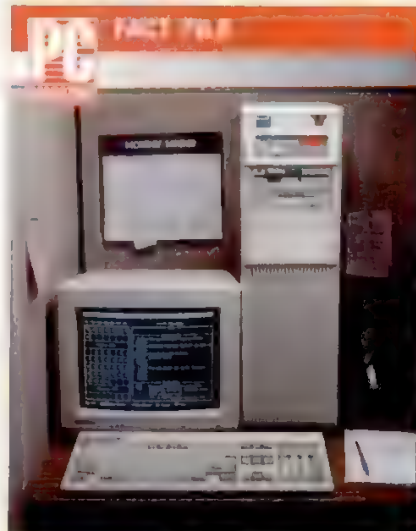
You can get up to 8MB of RAM on the motherboard and an additional 8MB with an expansion card. The tower configuration, which has room for seven half-height drives, provides a total of eight expansion slots (five open) plus eight cutouts for other connectors.

A Micropolis 160MB hard disk came in

the machine we tested. (The number of half-height bays means there's also room for options like two full-height 680MB hard disks and a 500MB internal tape drive, available from Softworks.) The 160MB hard disk, rated at 16 milliseconds, placed first in the small-records test and also achieved a very high score in the large-records test.

The inside of the Citus 386sx TS is spacious and orderly. The power supply is small, so the drive-bay area isn't crowded. The cables for the drives are neatly tied up and located out of the way of the slots.

Softworks provides a way for owners of the desktop model to upgrade to the tower



Citus 386sx TS

Softworks Development Corp., 5985 N. Lilly Rd., Menomonee Falls, WI 53051; (800) 332-3475, (414) 252-2020

List Price: With 1MB RAM, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, one parallel port and two serial ports, DOS 4.01, \$1,695; with 40MB hard disk, VGA monitor, \$2,930; with 160MB hard disk, 1.2MB and 1.44MB floppy disk drives, superscan VGA monitor, \$3,994. 1MB RAM upgrade, \$200

In Short: The Citus 386sx TS is an excellent machine. Its performance on the PC Labs benchmark tests puts it very near the top. Because it's a tower model, it has great expansion capacity, yet the price is quite reasonable. It would be a fine choice either as a standalone system or as a network file server.

CIRCLE 545 ON READER SERVICE CARD

configuration. For \$395, the service company, Monroe Systems for Business, will perform the upgrade on-site.

The Citus 386sx TS rates as one of the best choices around for a 386SX computer. It combines all the elements that make a personal computer worth your hard earned dollars: superior and consistent speed, exceptional expansion capability, a clean and solid design, plus a reasonable price.

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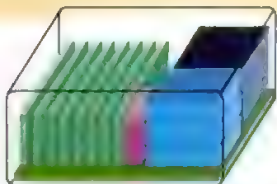


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SUNBURST SYSTEMS INC.

Sunburst 386SX-16

by Bill O'Brien



Following in the tradition of Chevrolet's second-generation Nova, which was really a Toyota under the bow tie emblem, the small-footprint chassis of the Sunburst 386SX-16 encloses the complete internals of an Orchid Technology Computer.

The motherboard in the \$2,149 test machine is actually an active backplane, called the Orchid Privilege; it contains the support chips needed to drive a CPU board as well as eight RAM banks. The banks come in an odd assortment, having both old-style DIP sockets and the current favorite, SIMM slots. The two types are mutually exclusive; a jumper on the backplane determines whether the CPU board will address the SIMMs or the DIPs.

The CPU board carrying the 80386SX, AMI BIOS, 80387SX math coprocessor socket, and Orchid chip set mounts in an extraordinarily long proprietary slot along the left side of the chassis. The original intent was to furnish an easy upgrade path to other processors on the CPU through the vehicle of this not-so-standard backplane. According to Orchid, a 20-MHz 386 upgrade is available now.

A SUNNY PERFORMANCE?

The video system is an Orchid VGA Designer 800 board that delivers a good image to the included Relisys VGA monitor. The monitor's claimed 720 by 480 resolution produced excellent VGA-level *Microsoft Windows* images with no folds, tears, or bends. However, the Orchid VGA was not a competitive performer in the benchmark tests that exercise the text-handling capability of a video card.

The 40MB Toshiba drive fell victim to the ST-506 interface and standard MFM encoding; despite its 28-millisecond access time, it produced nearly the worst throughput results of any machine tested.

The processing results, however, were good. The Sunburst qualified for fifth place among all machines in the 80386 In-

struction Mix test. The 100-nanosecond RAM chips, aided by zero wait states, placed it fourth on the conventional memory test. When many of the processing and RAM functions were tied together under the aegis of the floating-point calculation test, the machine garnered fifth place. That overall ranking placed it in the high end of processing performance.

The tests prove that while the basic computing sections of the machine are reasonable, the I/O segments need some reshuffling. You could shave some seconds off disk performance times (making program loading and data retrieval faster than on the tested system) by choosing Sunburst's alternative 80MB ESDI drive, but this will bump the system price up by \$290. You could also purchase better video boards from Sunburst, including the 16-bit Paradise Systems VGA-Plus, which offers 800 by 600 resolution, for \$130 more, or the Video Seven VRAM, which gives you 1,024 by 768 resolution, for about \$300 more.

If you find these changes necessary, the price of the machine jumps to \$2,500 or more. While a few other machines may of-



Sunburst 386SX-16

Sunburst Systems Inc., 43068 Christy St., Fremont, CA 94538; (800) 336-3388, (415) 651-1888.

List Price: With 2MB RAM, 40MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, VGA monitor, utilities, DR DOS 3.41, \$2,149; with 80MB hard disk, \$2,439; with 150MB hard disk, \$2,805; with 300MB hard disk, \$3,306.

In Short: Despite fast processing times, the Sunburst 386SX-16 lacked the I/O performance that would make it a better value. A transplant of both video and hard disk systems should satisfy demanding users.

CIRCLE 546 ON READER SERVICE CARD

fer better performance and sell for a few dollars less, Sunburst's expansion capability via Orchid's CPU boards is something that can't be overlooked.

TANDON COMPUTER CORP.

Tandon PAC 386sx

by Alfred Poor



The Tandon PAC 386sx's unusual design would make it stand out in a crowd, even if nothing else did. The \$4,087 mini-tower has only one floppy disk drive—and no bays for a hard disk.

Instead of a fixed disk, you get Tandon's own Data Pac, a removable hard disk system that comes in 30MB and 40MB configurations. The test unit we received came with two 40MB Pacs. These units fit into large slots that are covered by a hinged door; the slot-and-door combination looks like it was designed for homing pigeons rather than for high-tech storage devices.

The handling of packs is automated and under software control. Insert the Data Pac gently into a slot, and a motorized arm grabs it and pulls it all the way in. There's no mechanical release or button you can press to eject the unit; that operation, too, is under software control.

A positive feature about the Data Pac is its removable design: as long as you have plenty of them, you'll never run out of storage space. And you have the advantage of being able to take sensitive data with you when you leave the office. On the downside, the Data Pacs are more expensive than equivalent hard disk drives (the 30MB model lists for \$429; the 40MB for \$539) and the system relies heavily on sensitive mechanical components. We encountered a few problems with the drives, including a Data Pac failure and a slot that refused to load a drive properly.

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Feature	AST Premium 386SX/16	COMPAQ DESKPRO® 386s	COMPAQ DESKPRO® 286e	IBM® PS/2™ Model 55
Processor Type	386SX	386SX	286	386SX
Speed	16 MHz	16 MHz	12 MHz	16 MHz
Available Slots	5	4	4	3
EMS Support				
Software Included	4.0	3.2	4.0	No
Landmark Benchmarks*	23.1	15.4	11.6	15.3
List Price**				
One-Floppy System	\$2,695	\$3,299	\$2,699	\$3,895***

*Landmark Software version 1.1 benchmarks - a generalized index used to compare one machine to another. The higher the number, the better.

**List price is MSRP.

***List price with 30 MB hard drive - one floppy system not available with this model.

So, if you're considering an 80286- or 80386SX-based computer from a manufacturer like Compaq® or IBM®, make sure you compare it to the AST Premium 386SX/16. After all, if your needs require a workhorse, shouldn't you buy a thoroughbred?

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COMPUTERS 386SX MACHINES

sue. The Tandon motherboard takes up to 8MB of 16-bit RAM in SIMM packs; you'll need a third-party memory board to bring the system up to its 16MB maximum, but the memory on the card will be less speedy because the bus runs at a slower speed.

Not that the Tandon is a speed demon, anyway: it scored near the bottom of the pack in our memory tests. And although



Tandon PAC 386sx

Tandon Computer Corp., 609 Science Dr., Moorpark, CA 93021, (805) 523-0340.

List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, one parallel port, one serial port, Windows 386, BASIC, DOS 3.3, \$2,299; with 40MB hard disk, VGA monitor, \$4,087; with two 40MB hard disks, \$4,753.

In Short: The Tandon PAC 386sx requires you to make a commitment to its nonstandard Data Pac removable hard disk packs. The removable media are useful, but cost and reliability issues make the system less appealing than some alternatives.

CIRCLE 547 ON READER SERVICE CARD

the Data Pac removable hard disk drives use a controller that includes a 64K cache on board, they fared poorly on the disk segment of the benchmark tests.

The motherboard has but five slots: one 8-bit and four 16-bit. A parallel and a serial port are also on the motherboard, attached to 25-pin connectors on the back of the case.

Considerately, the machine's designers placed the power and reset switches conveniently on the front of the case. And the company has seen to it that the product comes with good documentation and plenty of software, including *Microsoft Windows/386*. A toll-free number for technical support and a one-year parts and labor warranty (which requires you to return the unit to the dealer) are also welcome extras.

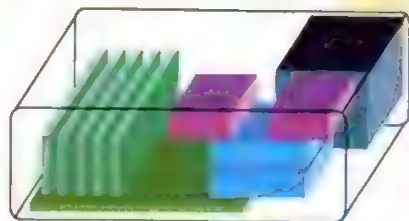
In the final analysis, you will buy the PAC 386sx only if you are ready to commit to the Data Pac design. While it has

some advantages, many will find that its extra cost and complex mechanisms may outweigh its benefits. You will probably find more flexibility and better value with a more traditional design.

TANDY CORP.

Tandy 4000 SX

by Tom Unger



Tandy has produced a 386SX machine that arrives ready to go to work. The \$2,599 4000 SX comes with a disk-based setup utility and straightforward documentation that lets you easily determine your system's basic characteristics.

Underneath an unassuming gray plastic exterior that measures 6.25 by 16 by 17 inches (HWD) is Intel's 80386SX processor, 1MB of high-speed DRAM, a 19-millisecond, 40MB MiniScribe hard disk, a 3.5-inch high-density floppy disk drive, as well as a 200-watt, 125/220 volt switchable power supply.

Both the hard disk, with its on-board integrated drive electronics (IDE), and the floppy disk drive cable connect directly to the motherboard, thus freeing an expansion slot normally taken up by the controller card.

Each of the drives in our evaluation machine fits into its own well-braced, one-third-height slot, leaving room below for two more half-height devices like a tape backup unit or a second floppy disk drive or hard disk. The 4000 SX includes cabling for two floppies and two hard disks, although Tandy's occasional lack of attention to engineering detail shows itself here: the excess cable was simply taped to the machine's metal bottom. The system also includes a drive-access LED that hangs loosely inside the case from its solder points.

The 4000 SX's motherboard sports five 16-bit expansion slots, one of which is occupied by the standard VGA card. Both a 9-pin serial and a standard parallel port, located in the back of the machine next to the

keyboard jack, are built into the motherboard.

There's not a byte of RAM on the motherboard: two dedicated page-mode memory slots hold all the memory for the system. Up to 8MB of SIMMs can be mounted on each expansion card (one board comes standard with four 256K RAM SIMMS); these are then plugged into the dedicated slots. System and Video ROM are automatically shadowed into RAM on boot-up; Tandy claims to be working on a way to access the remaining memory between the 640K DOS limit and the 1MB boundary.

Tandy's 101-key Enhanced-style keyboard is disappointing. Its mushy springs



Tandy 4000 SX

Tandy Corp., 1800 One Tandy Center, Fort Worth, TX 76102; (817) 878-4969.

List Price: With 1MB RAM, 1.44MB 3.5-inch floppy disk drive, one parallel port and one serial port, utilities, \$2,599; with DOS 3.3, \$2,719; with 40MB hard disk, VGA monitor, \$3,869. 1MB RAM upgrade, \$600; SCO Xenix operating system, \$795.

In Short: A mushy keyboard, the lack of a mouse port, and some sloppy design characteristics mar an otherwise solid entry into the 386 market. Still, innovative memory layout, better-than-average speed, and plenty of room for expansion make the 4000 SX a strong addition to the popular Tandy line.

CIRCLE 548 ON READER SERVICE CARD

and wobbly keyposts lack the crisp feel of other systems' keyboards.

On the positive side, the VGM-300 monitor included with our evaluation unit was bright and sharp. And even though it's no high-powered screamer, the 4000 SX's test results were consistently in the upper half of the machines we tested. If you're interested in a reasonably well-constructed, nicely priced machine, then the 4000 SX could be for you.

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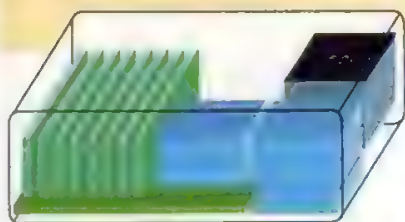
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TANGENT COMPUTER INC.

Tangent 316SX

by Winn L. Rosch



High-performance PCs custom-built to your specifications are what newcomer Tangent Computer offers: you specify what you want (processor, disk, case, and so forth), and it will ship you a turnkey package with a one-year on-site warranty. In addition, the one-year-old company of-

SX

**While the Tangent 316SX,
delivering midstream
performance, isn't the
fastest of the machines
we reviewed, the wealth of
options that you can
select from is enticing.**

SX

fers expert guidance, advising you which components to choose and which to touch only with an 11-foot pole.

That philosophy makes the 316SX a representative of the company's capabilities rather than a true off-the-shelf computer. As for the \$2,599 316SX unit sent to PC Labs, Tangent started with a classic AT case, laid in a Mylex Corp. 80386SX system board and 4MB of RAM, slid a pair of brand-name expansion boards into its slots (an Adaptec floppy/hard disk controller and a Video Seven FastWrite VGA adapter), added a color VGA monitor, and bolted down a decent Toshiba 67MB hard disk and a generous 285-watt power supply. The result is a machine you'd be proud to say you made yourself.

The review unit (which earned only an FCC Class A rating) was far from perfect: dimensionally askew, its expansion slots

COMPUTER 386SX MACHINES

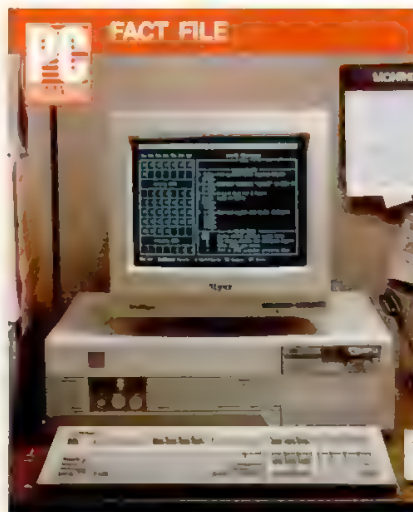
were a trifle too long for full-length cards to engage in their guides. The big, three-quarter-inch Turbo switch on the front control panel didn't work (speeds could be shifted between 16 and 8 MHz at the keyboard), but the matching reset button boot-ed through any disaster.

The oddest part of the 316SX hardware was a 9- to 25-pin adapter for its lone system-board serial port, which was grafted *inside* the chassis, ostensibly to mate with one of the three 25-pin cutouts in the rear panel. Next to it was the standard parallel port.

Aside from these small imperfections, the workmanship on the 316SX is good, with all its cables neatly tied down, the drives snug on their AT-rails, and the whole system securely bolted together.

The unit supports up to 8MB of page-mode interleaved memory on the Mylex board, using 1-megabit SIMMs in its eight sockets (256-kilobit SIMMs will also fit). The 316SX can selectively shadow both its Phoenix system BIOS and its video BIOS in 128K blocks, thanks to its Intel/Zymos chip set.

While the system isn't the fastest of the



Tangent 316SX

Tangent Computer Inc., 303 Beach Rd., Burlingame, CA 94010; (800) 223-6677, (415) 342-9388.

List Price: With 512K RAM, 42MB hard disk, 1.2MB 5.25-inch floppy disk drive, monochrome monitor, \$1,525; with 1MB RAM, VGA monitor, one parallel and one serial port, \$2,413. 1MB RAM upgrade, \$270.

In Short: A custom-configured computer with a variety of options packed into a conventional AT case. Workmanship and performance rate only average, but the component choice and pricing are commendable.

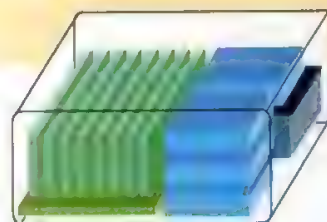
CIRCLE 549 ON READER SERVICE CARD

machines we reviewed, delivering mid-stream 386SX performance on our benchmark tests, the wealth of options that you can select from is enticing. (That you can get a bare bones base model for \$996 is intriguing, too.) If you'd like a system tailored to your specifications but don't want the nuts-and-bolts hassles of constructing it yourself, the 316SX is for you.

TATUNG COMPANY OF
AMERICA INC.

Tatung TCS-8800S

by Fredric Burke



Tatung, a company long known for its monitors and more recently for its PCs, is jumping into the SX waters with the TCS-8800S. At a cost of \$4,595, the test system is one of the most expensive machines reviewed here; on the positive side, it is both well-equipped and speedy.

The test configuration came with an excellent Tatung VGA monitor, 8MB of 100-nanosecond RAM, a 90MB Control Data Corp. hard disk, a Matsushita 1.2MB and a TEAC 1.44MB floppy disk drive, and a Forward Electronics 101-key keyboard. The unit boasts three 8-bit slots and three 16-bit slots, in addition to the slot taken up by the VGA card.

Tatung is generous with software. The TCS-8800S comes with DOS 3.3, Phoenix's disk-caching utility and extended memory manager, and GW-BASIC. A speed-switching utility lets you toggle between 8 and 16 MHz. A one-year warranty and four months on-site service from Memorex Telex rounds out the package.

This small-footprint machine—5.9 by 17.3 by 16.3 inches (HWD)—proved itself a winner on our benchmark tests, scoring in the top ten in almost all of the tests. The zero-wait-state machine relies on interleaved page-mode DRAM and an 18-millisecond ESDI hard disk.

FLIMSY PACKAGING

There is one important problem with the TCS-8800S: it looks and feels flimsy. The

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chassis bends easily, and the surfaces of the metal brackets that hold the floppy and hard disk drives are unfinished. A piece of plastic trim on the front of the box came off in my hands.

The outside of the case is nicely styled, but the on/off button is positioned about only half an inch off your tabletop, and it's big enough that you can't miss it, even if you want to.

Inside the case, cables and wiring snake along their own courses rather than following an orderly plan. An internal drive bay is mounted over the power supply, where an installed device will slowly fry. In addition, the motherboard contains the floppy disk drive controller, but if you decide on the optional hard disk, you'll have to spring for an additional controller card as well.

The price of this machine and the fact that it comes from a company as large as Tatung makes it difficult to ignore such major flaws. Tatung says it is taking steps to correct these problems, as it should. If the company is looking to make a splash in the 386SX pond, it is going to need a better rock.



Tatung TCS-8800S

Tatung Company of America Inc., 2850 El Presidio St., Long Beach, CA 90810; (800) 827-2850, (213) 979-7055.

List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, two serial ports and one parallel port, diagnostics, utilities, DOS 3.3, GW-BASIC, \$2,895; with 40MB hard disk, VGA monitor, \$2,895; 106MB hard disk, ESDI controller card, with 1.44MB floppy disk drive, VGA monitor, \$4,595.

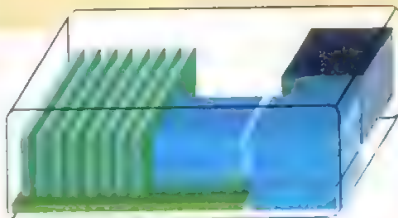
In Short: The Tatung machine counters fine speed and good components with below-average construction and a price that most of its competitors beat handily. Tatung says it is correcting these problems, but right now the TCS-8800S is hard to recommend.

CIRCLE 560 ON READER SERVICE CARD

COMPETITIVE 386SX MACHINES

UTI COMPUTERS UTI 386 SX

by Alfred Poor



The UTI entry in the SX competition comes with an attractive base price of just \$1,099, although by the time you build it up with a 40MB hard disk and color VGA setup, the cost balloons to \$2,126. But even at that price, the UTI 386 SX still rates as one of the least expensive systems reviewed here.

In more than one way, the system stands apart from many of the other machines we tested. The most noticeable difference is that UTI has stuck with the traditional AT-clone case, eschewing the trendy design of downsized minitowers, small-footprint desktops, and low-profile slimline cases. This means you get the larger-size machine's expansion options, like five half-height drive bays with three accessible from the front.

Inside, you'll find more differences. The UTI uses components that are hardly household names. The motherboard is UTI's own, and the disk controller is from DTC (Data Technology Corp.). The keyboard and floppy disk drives come from Mitsumi Electric. The most familiar components are the ATI Technologies VGA Wonder-16 video card, a Mitsubishi half-height hard disk, and the Award BIOS.

INTERESTING ELEMENTS AND QUIRKS

The motherboard has some interesting elements. The case has openings for eight expansion slots, but the motherboard has only seven: five 16-bit and two 8-bit.

The unit makes provisions for both SIP and DIP DRAM packages. Our review machine came with 1MB of RAM in the form of 80-nanosecond 256-kilobit chips, but by using 1-megabit chips you can build the motherboard up to 8MB. While this might be plenty for now, some users may want more than 8MB of RAM before long. With the UTI machine, these users will have to settle for using slower 16-bit mem-

ory cards to increase RAM capacity.

The review machine came with no I/O ports. According to a company representative, UTI now includes a card with a parallel and serial port on all configurations at no extra charge.

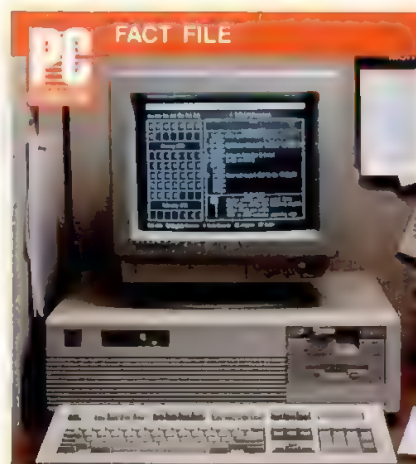
One of the machine's quirks is a setup utility in ROM that can be triggered with a combination keystroke from the DOS prompt, but only if your configuration is invalid. If your present configuration is acceptable, you must trigger the setup program during bootup. According to UTI,

SX

The UTI 386SX's average performance and poor support prevent it from rising above the pack.

SX

you have about a 2-second window where the keystroke will register, but there is no on-screen prompt that indicates when this time period will be. You'll just have to use the HKH approach: hit keys and hope.



UTI 386 SX

UTI Computers, 3640 Westchase Dr., Houston, TX 77042; (800) 237-4961, (713) 780-7170.

List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, monochrome monitor, two parallel ports, one serial port, one game port, diagnostics, utilities, \$1,099; with 40MB hard disk, VGA monitor, DOS 3.3, \$2,126; with 1.44MB 3.5-inch floppy disk drive, \$2,415. 1MB RAM upgrade, \$149.

In Short: The UTI 386 SX looks like a typical clone and comes with a price to match. The average performance and minimal warranty detract from the package, making other machines in the same price range more attractive.

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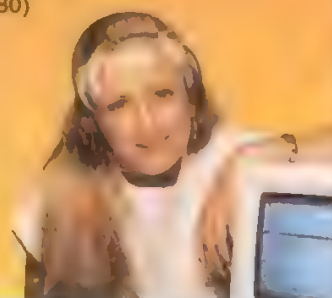
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What documentation there is is attractive, but on the whole, it's thin. You're on your own when it comes to figuring out installation and configuration.

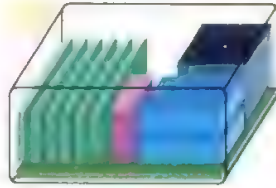
If the machine had great performance numbers or terrific support, it could still rise above the pack. Unfortunately, its performance is average (aside from the good video times turned in by the ATI board) and the support minimal: the one-year warranty requires the buyer to pay shipping one way to UTI for repairs. In today's market, on-site service is a selling point, and UTI's lack of it is no bargain.

The UTI fails to deliver the goods that would complement its attractive low price. There are other companies offering machines in the \$2,000 to \$2,500 range that provide better values.

WANG LABORATORIES INC.

Wang PC 350/16S

by Winn L. Rosch



While things haven't been going particularly well in the business offices of Wang Laboratories—the company lost \$424.3 million dollars last year—the engineering

department has been crafting wonders. One of them is the PC 350/16S, Wang's first truly mainstream PC-compatible.

A solid, small-footprint design, the PC 350/16S measures 6.5 by 16 by 16.25 inches (HWD). The \$4,620 machine (with 1MB RAM, 40MB hard disk, VGA monitor, DOS 3.3) shows few external distinctions: a darker, gray-green color, and a front-panel push-on/push-off power switch.

The inside of the system stands out, however. Its superb workmanship is more of what you'd expect in a pricey Wang minicomputer—heavy steel everywhere, with two topside rails for additional reinforcement. The only design lapse is the location of the plug-in 80386SX microprocessor platform—which also holds a



EDITOR'S CHOICE

• AST Premium 386SX/16

Although speed probably isn't your first consideration if you're purchasing an SX, speed on the PC Labs benchmark tests typically indicates smart, well-executed design. Of the 31 SX machines included in this roundup, three of the fastest finishes are worthy of our Editor's Choice: the AST Premium 386SX/16, the Austin 386SX, and the Zeos 386SX-16.

The Zeos is the fastest SX tested, scoring at or near the top on our nine tests, including two first-place and one second-place finish. Zeos combines performance with attractive pricing—\$2,252 for a VGA system with 1MB RAM and 65MB hard disk—packing plenty of value into its new case, including 60-nanosecond memory and a generous hard disk.

An equally impressive value is the Austin 386SX, which sells for \$2,195 in our standard configuration with 1MB RAM, 42MB hard disk, VGA, and DOS. With six open expansion slots, a one-year on-site service contract from GE, and benchmark test scores that aren't the fastest but generally won't disappoint either, Austin offers expansion possibilities, service, and performance at a great price. You might want to replace the Western Digital VGA Plus 16 adapter with a faster card.

The AST Premium 386SX/16

• Austin 386SX

comes at a premium, but dealer discounts should knock the \$4,385 price for our standard configuration down by \$1,000. The Premium 386SX/16 incorporates disk and I/O functions on a not-quite-passive system board, but all processor functions are on a dedicated CPU card. This architecture provides for an easy upgrade to 25- or 33-MHz 386 performance, as well as 486-based computing, simply by swapping your processor card. AST's SX card is no slouch either, finishing second on our benchmark tests.

Honorable mention goes to four others: the computers from Epson, Gateway, NEC, and Softworks. The Epson Equity 386SX sells at a pricey but discountable \$4,297 in our 40MB VGA-equipped standard configuration, and the 386SX Gateway 2000 Multiperformer costs \$2,295 similarly configured. Epson's list price equals that of many full 386 systems, but its clean design, fast performance, and dealer discounts make it a more attractive choice. With Gateway's low price, you get plenty of power for your money, but we recommend a faster hard disk than the 40-millisecond Seagate ST-251 in the tested unit.

For those of you interested in long-term quality, consider the NEC PowerMate SX Plus. At \$4,398,

• Zeos 386SX-16

configured with 1MB RAM, 40MB hard disk, VGA, and DOS, the PowerMate SX Plus offers solid construction built for the duration. Like Epson, NEC sells through dealers, and you can expect to negotiate a 25 percent discount off the list price.

The \$2,930 Citrus 386sx TS from Softworks was another strong performer on our benchmark tests. Change a jumper on the system board and this unique system can be run at 20 MHz for even faster performance. While *PC Magazine* does not recommend pushing the processor past its rated speed, Softworks guarantees its system at both 16 and 20 MHz, including one year on-site service.

And as we have said in the past, keep the new IBM PS/2 Model 55SX in mind. At \$4,668 for 2MB RAM, a 30MB hard disk, VGA, and DOS, it's no bargain, but it's compact and well designed. If you're not concerned about expansion, it's worth considering as a fast LAN workstation.

Finally, if you're looking for an SX, chances are you'll need only a handful of free slots available, so consider a small-footprint design that still holds 4 to 6 expansion slots. Of the machines discussed above, the Austin, Epson, and NEC fit that bill.

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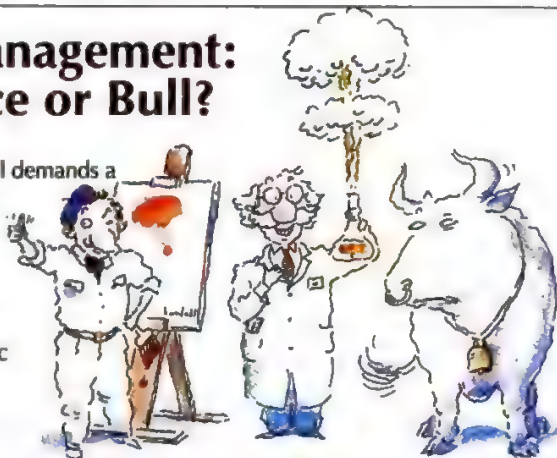
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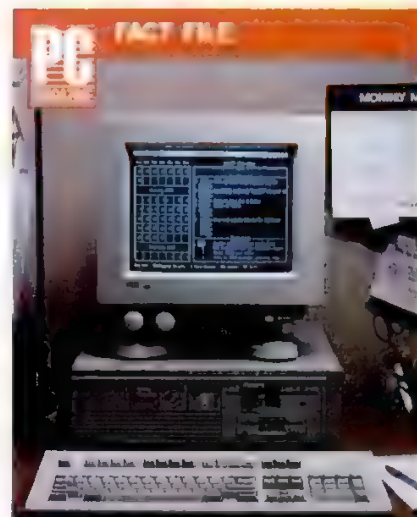
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8086SX MACHINES



Wang PC 350/16S

Wang Laboratories Inc., Inquiry Service M/S 014-03C, One Industrial Ave., Lowell, MA 01851;
(800) 522-9264.

List Price: With 1MB RAM, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, one parallel port and two serial ports, diagnostics, LIM EMS 4.0 driver, \$2,695; with 40MB hard disk, VGA monitor, DOS 3.3, \$4,620. 1MB RAM upgrade, \$595.

In Short: A small-footprint machine with heavy-duty construction, adequate performance, built-in IDE interface, two 5.25-inch drive bays and one 3.5-inch hard disk bay.

CIRCLE 602 ON READER SERVICE CARD

socket for the optional 16MHz 80387SX coprocessor — under the drive bays. Switching platforms or adding a coprocessor requires pulling either the disk drives or the system board out of the case. (The platform-mounted microprocessor does, however, let you field-upgrade the almost identical 80286-based twin of the PC 350/16S to 80386SX abilities with a simple platform swap.)

EXPANSION, MEMORY, AND SPEED

The system features six expansion slots. The rightmost slot, which uses an 8-bit interface, allows the use of only half-length expansion boards because of the intrusion of the vertically mounted hard disk.

The expansion bus lopes along at an ultra compatible 8 MHz. The 16-MHz processor speed can be slowed to 8 MHz through the keyboard or software.

The page-mode memory is interleaved to reduce wait states to an average of 0.5 (with four memory banks). Eight system-board sockets accommodate either 256-kilobit or 1-megabit SIMMs—enough for an on-board total of 8MB.

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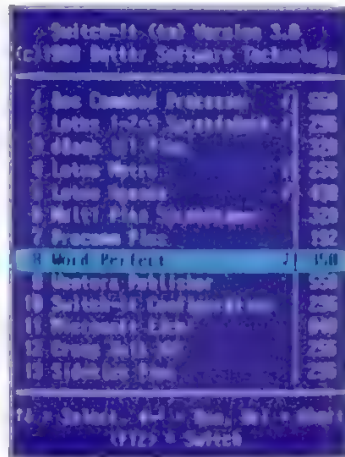


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Benchmark	Microsoft BASIC	Microsoft QuickBASIC	Borland* Turbo Pascal [®]
SAVAGE	129.1	449.9	281.0
FILE I/O	49.7	72.8	51.5
HAT	183.8	568.5	303.8
SCREEN	2.4	4.3	15.8
Matrix Ops	13.2	66.2	56.5
QuickSort	1.6	2.5	2.3
4P CALLS	0.3	1.0	0.6

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 - Customizable utility menu for DOS commands and preferred utilities.
 - More complete set of compiler controls.
 - Double permitted number of watch expressions.
- Microsoft Editor and CodeView[®] debugger allow mixed language and OS/2 programming.

COMPUTERS 386SX MACHINES

PC 350/16S supports ROM shadowing and also allows up to 704K RAM to be assigned to DOS when the system is equipped with an old-fashioned monochrome display adapter. (EGA and VGA displays appropriate the memory between 640K and 704K.) The Wang expanded memory manager, compatible with LIM EMS 4.0, works in real and virtual modes and can act as if the system board memory above the 256K boundary has been back-filled with EMS, which speeds multitasking applications.

In testing, the evaluation machine proved to have respectable but not remarkable performance, coming in at the middle of the pack in most of the benchmark tests.

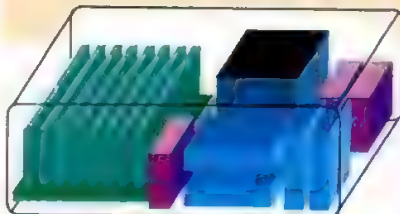
STOP AND SHOP

Like the large PC vendors, Wang offers one-stop shopping. The company offers almost any conceivable option, most wearing Wang's label even when they're from other vendors. For instance, a \$150 Logitech mouse sports a Wang name tag. Wang manufactures its own stylish 14-inch VGA display (\$725), which looks like a sci-fi creature on four rubber feet.

And like the big players, Wang gives you more documentation than can be navigated without an astrolabe; it has also begun putting its machines into retail stores. With such a solid system and pricing that's aggressive compared with IBM and Compaq's (but not with that of smaller vendors), Wang has the potential to make its mark on the PC market.

ZEOS INTERNATIONAL Zeos 386SX-16

by Bill O'Brien



The latest incarnation of the Zeos 386SX-16 is priced at a competitive \$2,252, including 1MB of RAM made up of 256-kilobit 60-nanosecond DIP chips, a 65MB Seagate ST-277R drive, and an Adaptec RLL controller. The system is not only

\$40 cheaper than its predecessor (reviewed in our August 1989 issue), but it also replaces the other model's 100-ns. RAM with fast 60-ns. chips on a new motherboard of Zeos's own design.

Along with the technology redesign, the Zeos case has gotten a face-lift. While the components could well fit inside the original's small-footprint enclosure, Zeos

SX

**The Zeos 386SX-16 is not
only \$40 cheaper than
its predecessor, but it also
replaces the earlier
model's 100-ns. RAM with
fast 60-ns. chips.**

SX

has opted to use a seven-eighths-size chassis—that's just a wee bit narrower than an AT case—with a plethora of nooks and crannies for expansion devices.

The front of the machine will fool you into thinking that you're limited to a mere pair of half-height drives and a sliver of a third-height device crammed down at the bottom. Pop the hood and you'll find another story. Zeos claims that seven devices in all can fit into its SX: a 3.5-inch cutout marks the face of the chassis face immediately to the left of the externally visible drive bays, and a corridor along the right side of the machine holds additional half-height and 3.5-inch bays.

Anyone who takes advantage of the Zeos's full range of expansion capabilities will appreciate the steps that the company has taken to avoid percolating the system. In its standard configuration, the chassis includes two fans: the usual one contained in the power supply, and a small whisper fan mounted against the front of the chassis that evacuates hot air through vents in the computer's faceplate. For stubborn installations with high-power boards or devices generating excessive heat, an optional third fan can be mounted at the right rear of the chassis at the expense of a 3.5-inch mounting bay.

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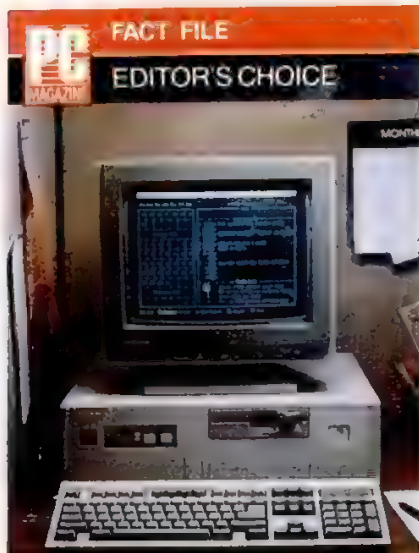
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COMPUTERS 386SX MACHINES



Zeos 386SX-16

Zeos International, 530 5th Avenue N.W., St. Paul, MN 55112; (612) 633-4591.

List Price: 512K RAM, 20MB hard disk, 1.2MB 5.25-inch floppy disk drive, one parallel port, two serial ports, game port, monochrome monitor, \$1,395; with 1MB RAM, 65MB hard disk, VGA monitor, DOS 3.3, \$2,252.

In Short: The Zeos 386SX-16 is one of the speed champions of this evaluation. Combine that performance with great expandability, quality parts, and down-to-earth pricing, and the result is a winner.

CIRCLE 603 ON READER SERVICE CARD

many third-party units. And buttons for reset, turbo, and power are all accessible from the system's front panel.

To its credit, Zeos has shied away from extruded on/off switches or Rube Goldberg-like mechanical extension rods and instead uses a square flush-mounted button that's wired to the power supply. However, the cabling exits the back of the switch directly into the drive-bay area, and its position might cause some mounting discomfort when you install devices in the internal half-height bays. It shouldn't be difficult to reroute the cable, though.

As for speed, Zeos comes in a winner. Not only did the company's own brand of VGA display and card (with a Paradise Systems chip set) prove to be one of the fastest overall, but the Zeos also scored outstanding times on the 80386 Instruction Mix and the Floating-Point Calculation benchmark tests, where it placed second and first, respectively.

The Zeos 386SX-16 successfully combines the two things people most want in their systems: solid performance and attractive pricing. With so much going for it, how could you go wrong?

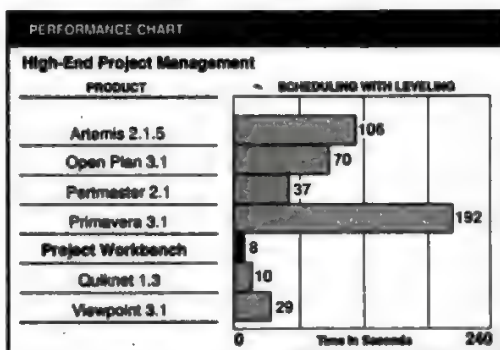
Autoschedule

		July 1989						
New Products	Day	Resrc	26	3	10	17	24	3
MARKET ANALYSIS								
Plan Analysis								
Define Objectives	6	JD	C.....					
Arrange Resource								
Conduct Interview								
Interview Corp								
Interview Opera								
Interview Marketing	6	LA						
Consolidate Findings	10	LA TB						CL
Utilization								
John Davis	4.0v	JD	4.9	4.3	2.1	1.8	1.0	
Tom Benson	5.0v	TB	0.5	2.6	4.5	3.4	2.4	
Larry Ashton	5.0v	LA		1.0	3.9	4.1	6.1	
Total days			5.4	7.9	10.5	9.3	9.5	

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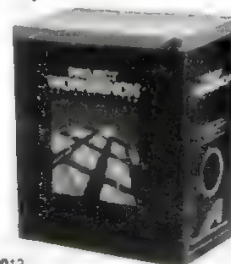


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Monitor	OPTION	OPTION	OPTION	OPTION
Fixed Disk	OPTION	OPTION	OPTION	OPTION
Floppy	720 KB	1.44 MB	1.44 MB	1.44 MB
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Note: Information on this chart is based on published materials.

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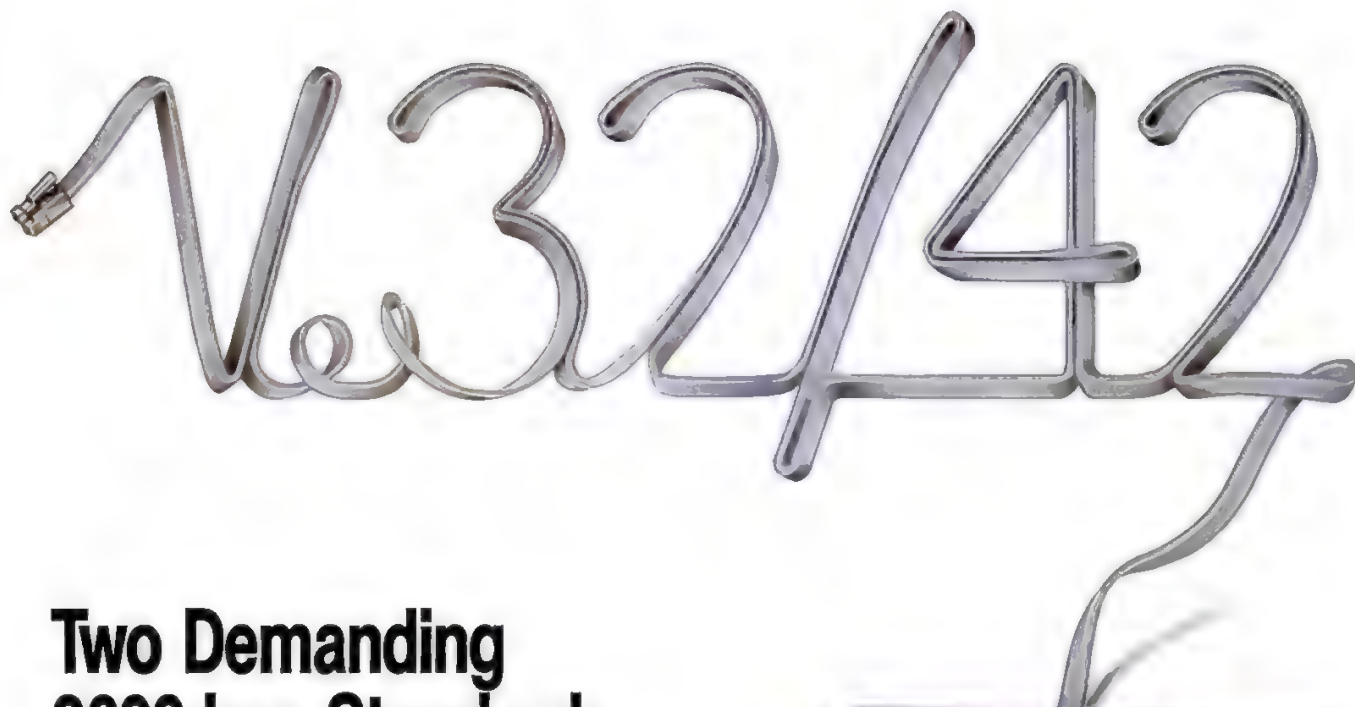
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DIRECT TOKEN-RING TO MAINFRAME CONNECTIONS

by Frank J. Derfler, Jr.

Pity the network administrator who has to sort through the increasingly bewildering number of ways to link PCs and IBM mainframes. There are IBM coaxial cables, several kinds of network gateways, and connections over token-ring networks to examine. The pros and cons of these alternatives are highly technical and the vocabulary intimidating, but selecting the right method of connection can improve the service you receive from the mainframe and/or save you money on PC and mainframe equipment.

The classic method of attaching a PC to a mainframe is via a coaxial adapter board in the PC—DCA's IRMA card being the archetype. Linking all PCs together through a network and selecting one networked machine as a gateway to the mainframe is a more popular and economical process. (For a two-part evaluation of LAN gateway products, see the November 29, 1988,

and December 13, 1988, issues of *PC Magazine*.) In this issue, we look at two variations on the gateway connections that give greater throughput (see "Alternatives to Direct Token-Ring Attachment"), but our main focus is on the micro-to-mainframe attachment scheme that IBM urges its major accounts to consider: the direct token-ring connection.

The coaxial adapter card architecture, pioneered by DCA and now offered by a dozen companies, supplies each PC with a direct coaxial attachment (common to IBM 3270 terminals) to the mainframe's terminal cluster controller. The PC runs software that makes it act like an IBM terminal, and the mainframe regards it as such. Data

**IBM wants you to know
that token-ring LANs
can make good connections
to mainframes
if you have the right software.
Attachmate, DCA, Banyan,
and Novell agree.**

CONNECTIVITY

TOKEN-RING TO MAINFRAME

is transmitted via standard IBM 3270 cables. The terminal emulation software in the PC not only lets you transfer files between the PC and the mainframe, but it typically lets you toggle between mainframe sessions and DOS programs.

Because this type of architecture calls for a dedicated port for each PC on the mainframe's terminal cluster controller—whether or not it is active—connecting a large number of PCs via this method becomes expensive. The performance, measured in terms of throughput and response time, is good and the installation easy, but the costs for mainframe hardware are high.

LAN GATEWAYS

The LAN gateway alternative significantly reduces the cost of mainframe hardware needed for multi-PC to mainframe installations. One PC, usually dedicated to the task, acts as a gateway; this is the only machine that connects directly to the mainframe. The mainframe regards this gateway as a terminal cluster controller and talks to it over one of a variety of communications links.

In this configuration, the workstation PCs run terminal emulation software and share the single mainframe connection through the gateway. If you use the network for other things, like file and printer sharing, the per-PC cost of attaching to a mainframe can be very low. The primary cost factors are the price of the gateway computer, the gateway/terminal emulation software, and the connection scheme you choose.

The gateways we tested last year used a relatively slow SNA synchronous data link control (SDLC) connection operating at 19.2 kilobits per second (kbps). Connection options such as coaxial attachment and attachment over a token-ring network between the gateway and the mainframe create a link that operates at speeds up to 16 megabits per second.

Our reviews of gateway software found that the throughput over the shared 19.2-kbps SDLC line adequately supports a dozen or more PCs acting as terminals. While the overhead created by gateway activity on a typical network is negligible, if the PCs do more than terminal emulation—for example, exchange files or engage in program-to-program communications—the throughput over the shared link quickly becomes limiting. You can install more gateways on the network to divide the load, but that means a greater cash out-

This diagram illustrates the four methods you can use to connect networked PCs to a mainframe computer: three are gateway systems with different communications links; the fourth, a direct token-ring connection.

Each gateway connection uses a networked PC that connects to a piece of mainframe hardware appropriate to the communications path. The SDLC gateway connects to the IBM 37xx series communications processor (also called a front-end processor) over a 19.2-kilobit-per-second serial link. The 3299 coaxial multiplexer gateway connects to a properly equipped IBM 3174 terminal cluster controller.

The PCs emulating 3270 terminals can connect to their gateway machine over any type of network that provides NetBIOS services. Each PC runs its own terminal emulation software.

The token-ring gateway can attach to any of a variety of TIC-equipped systems. Similarly, the direct-connection token-ring network makes peer-to-peer connections

to a variety of computers and communications devices. The token-ring gateway requires a separate PC (or in the case of Banyan's system, the server) to act as the gateway, but the direct-connection scheme places more overhead on the mainframe equipment.



lay for PC and possibly mainframe hardware. It also means that you'll add to the workload of the network manager.

TIC TRICK

The method of PC-to-mainframe connection that IBM's sales force most frequently recommends is direct token-ring connection. Because the IBM Token-Ring Interface Coupler mainframe hardware has the acronym TIC, this architecture is usually called a "tick" or "tick connection."

The TIC endows IBM mainframe equipment—including the 3174 terminal cluster controller, several front-end processors, the AS/400 processor, and the 9370 mainframe—with the ability to connect to an IBM Token-Ring Network directly. Since PCs can also connect directly to a token-ring network, PCs and mainframes can interact as peers on the same network as long as each machine runs the appropriate software. This eliminates the need for gateways, dedicated coaxial cable connections, and slow speed communications channels.

The TIC generates fast response times. Our tests show that you can initiate a file transfer from the mainframe to a PC and receive a 50K file through the network in one second. Graphics screens sent by the mainframe seem to snap into place as soon as you hit the Enter key.

You're right if you suspect there's a catch to this too-good-to-be-true situation. In fact, there are several.

First, you must use IBM's Token-Ring Network cards and cables. While token-ring installations are robust and able to survive cable problems that disrupt other types of networks, the installation is expensive. The cable itself not only costs about 40 percent more per foot than thin Ethernet cable, but you also need many times the amount of cable for the same number of nodes. Additionally, for every eight nodes you install on a token-ring network, you need a \$600 hub. These hubs stack together in a relay rack; you need a room just for the rack and the centralized wiring ducts.

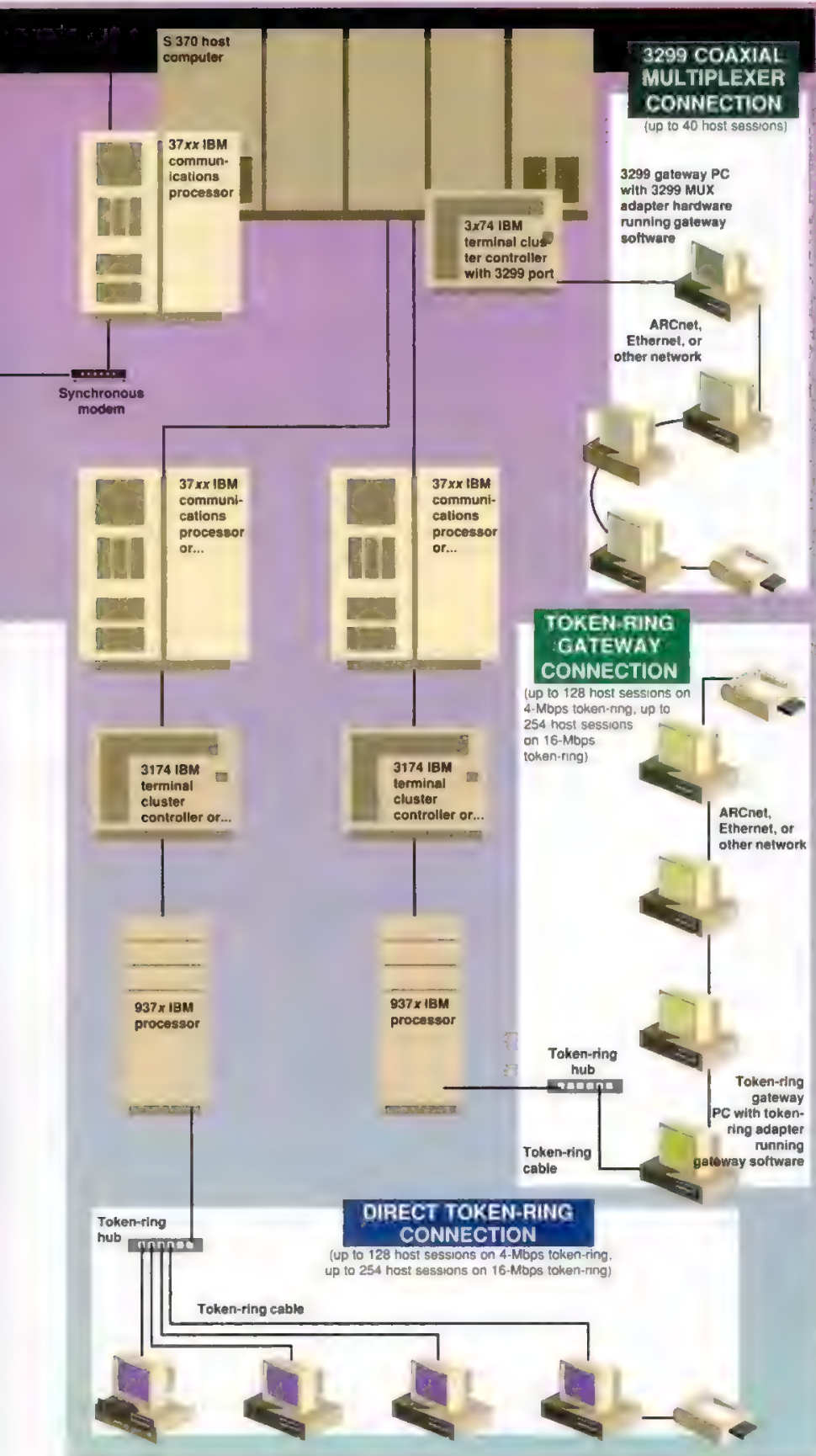
In addition, TIC equipment is not available for older versions of IBM's terminal cluster controllers or front-end processors. If you want to use the TIC architecture, you might have to upgrade to new mainframe communications equipment.

Without a gateway, each PC on the LAN is an SNA Physical Unit directly polled by the host system. All that polling activity can easily make your mainframe "I/O bound" and force you to upgrade even a new model of mainframe communications processor before you might otherwise need to.

Using the direct token-ring connection

CONNECTIVITY

TOKEN-RING TO MAINFRAME



requires close coordination between the people managing PCs and the people living with the mainframes. The system programmers tending the mainframe must explicitly define each SNA Physical Unit (that is, each connected PC) in the mainframe software. This means you must coordinate the addition and deletions of PCs with the mainframe system programmers and wait until they make the change to their software before the PCs can be serviced.

Lastly, if you use a network gateway to connect PCs and mainframes, only one Physical Unit is defined; that unit distributes many Logical Units or sessions to the connected PCs. You can add networked PCs in back of a gateway at any time, and they can immediately use 3270 SNA sessions. If you have been in this business for more than a few years, you know that configuration freedom was one of the driving factors behind the popularity of PCs. While the TIC option may appear simple, it can make management more complex.

SOFTWARE ALTERNATIVES

The products we review here are solely software-based. Since token-ring adapter cards supply the electrical connection to the mainframe, the PC-to-TIC products consist of 3270 terminal emulation programs, various utilities, application programming interfaces, and driver software that carries data to and from the token-ring adapter cards. The typical retail price for these packages is between \$400 and \$500 per station.

The terminal emulation portions of these packages differ mainly in the variety of IBM terminals they ape. Some products act like simple character-mode terminals, while others let the PC, driven by mainframe programs, display excellent color graphics screens. Most of them give you the option to remap the PC's keyboard so that various keystroke combinations send the expected messages from the special function keys on IBM terminals.

An Application Program Interface, or API, looks for inputs from other programs. When an API is available, people who write applications like accounting, inventory, and communications programs can use simple commands to move data through the network to the mainframe and interact with applications on the mainframe. The API converts the relatively simple commands that have been written in C or some other high-level programming language into the complex actions

CONNECTIVITY

TOKEN-RING TO MAINFRAME

needed to move, verify, and store data.

IBM defined several APIs for use with mainframe applications. Some of them require software running on both the PC and the mainframe, but others work locally in the PC. For instance, IBM's 3270-PC API and the High-Level-Language Application Program Interface (HLLAPI) run only on the PC; the Advanced Program-to-Program Communications (APPC) API requires software on both the PC and the mainframe, but it allows for a high degree of integration between PC and mainframe applications.

Our performance tests of LAN driver software prove that not all drivers are created equal; apparently, not every programmer has the special skills it takes to make these little programs both fast and efficient. Hence, despite the fact that we held every other variable constant, there were significant differences in the throughput of the products we tested.

THE TESTS

PC LAN Labs does not have a local mainframe to dedicate to the sole use of benchmark testing, so we turned, once again, to Harris Corp. of Melbourne, Florida, which gave us access to its mainframe on an exclusive basis. We used standard IBM PCs with IBM Token-Ring cards on a network that included IBM's 3174IL terminal cluster controller. The 3174IL communicated with an IBM 3084 computer suite dedicated to our testing activity.

The terminal activity for the tests was generated by the IC3270 mainframe software package marketed by Innovative Communications. (For more information on the tests generated by this software, contact Innovative Communications at (508) 875-4821 or (508) 655-4364.)

As noted, results show that the TIC interconnection is fast. The throughputs we measured for token-ring connection were, in some cases, 80 times faster than the throughputs we measured in the same tests using the same hardware connected through an SNA SDLC LAN gateway (see *PC Magazine*, December 13, 1988).

CONNECTION DAZE

If your organization is committed to token-ring architecture, using the TIC connection makes a lot of sense. You get fast service, tight mainframe integration with little communications overhead, and simple installation.

If token-ring is not your standard network architecture but you still want to

achieve fast mainframe connections, investigate the 3299 gateway multiplexer products described in the sidebar "Alternatives to Direct Token-Ring Attachment." These gateways let you use ARCnet, Ethernet, or any other network schemes for speedy, low-cost connections between PCs and mainframes.

It's not news that computer technology evolves at a steady pace. In a year or two, you'll probably find a new addition, the Integrated Services Digital Network (ISDN), in your list of micro-to-mainframe connection options.

ISDN, however, is the only new mast on the horizon. With that one exception, the micro-to-mainframe products are on the shelf and ready to use. It's a good time to make a decision on your organization's LAN-to-mainframe connection architecture.

Frank J. Derfler, Jr., is workgroup systems editor of PC Magazine.

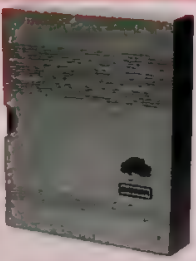
Banyan 3270/SNA Option

All reviews by Randol Tigrett

Banyan 3270/SNA Option (Version 4.0) is different from much of its competition in the token-ring attachment field. While companies like DCA and Novell give you the option of using either an all-peer token-ring architecture or establishing one gateway machine that talks to the mainframe, Banyan offers only the latter approach.

To use the Banyan system, you must designate a gateway computer to connect to the mainframe TIC over a token-ring network. The gateway PC may have an additional network adapter installed—perhaps using ARCnet or Ethernet cabling—to connect to the client workstations. In most networks, the gateway would be a dedicated, separate machine, but in the Banyan *VINES* system the software is designed so that the gateway function is performed by the file server.

Banyan's approach blends the speed of token-ring access with the potentially lower cost and flexibility of a gateway architecture. You will have to own or invest in a Banyan file server, though. In Banyan's system, the file server/gateway emulates a 3174 IBM terminal cluster controller com-



FACT FILE

Banyan 3270/SNA Option
 Banyan, 115 Flanders Rd., Westboro, MA 01581; (508) 898-1000
List Price: for 16 stations, \$2,990; for 32 stations, \$3,490; for 64 stations, \$4,490; for 96 stations, \$5,990. Server software (one package required for 3270/SNA): *VINES 386*, \$4,995; *VINES 286*, \$995.
Requires: DOS (version dependent on *VINES* version).
In Short: The *Banyan 3270/SNA Option* suffers from slow file transfer for small files but does well in transferring large blocks of data. The package has no support for APA or S3G graphics. Copy protected.

CIRCLE 406 ON READER SERVICE CARD

municating with a real IBM 3174 or some other TIC-equipped IBM mainframe over token-ring. The client workstations communicate with the gateway computer over any of a variety of network adapters supported by Banyan. (The server acting as a gateway in our tests was a 25-MHz 80386 Banyan Corporate Network Server (CNS) with 8MB RAM.)

The *Banyan 3270/SNA Option* (with prices starting at \$2,990 for 16 users) comes with the gateway software for the server and the emulation software for the workstations. Other versions of the package are priced according to how many SNA logical units or concurrent sessions they can distribute to the networked stations.

EASY TO INSTALL, BUT...

We have always found the Banyan *VINES* operating system to be simple to install but complicated to configure. An experienced administrator of a *VINES* network should have no problem getting it going, but if you're not familiar with the system, you should first opt for training in a Banyan school.

Once you have the Banyan server up and running, you'll need to install Banyan's workstation terminal emulation software. All the terminal emulation software goes into a stored directory on the server, from which it loads three programs that set up customized terminal emulation parameters into each workstation's RAM.

You can configure four terminal sessions—one printer and three display—with the emulation software. The printer session supports both LU1 and LU3 de-

INSUFFICIENT MEMORY



This message brought to you by your PC-Mainframe software.

Isn't it frustrating when your 3270 software eats so much memory you can't run your PC programs?

Meet EXTRA! Less memory, more smarts.

EXTRA! Connectivity Software™ uses less than half the memory of other 3270 programs. As little as

77K of memory for LAN connections. And a meager 44K for coax links.

You may find it surprising, therefore, that EXTRA! includes the

longest list of standard features in the industry. And the highest-speed IBM®-compatible file transfer, as measured by PC Magazine and PC Week.

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Call us for complete information about EXTRA! Before you forget.

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CIRCLE 199 ON READER SERVICE CARD

vices. This version of the product did not support APA (all points addressable) or S3G graphics.

The Banyan file transfer utility works only in foreground mode. Once you start a file transfer, you must wait until it is complete before processing other information. Since Banyan placed fourth out of the five products tested in file transfer speed, this is no small consideration. However, Banyan demonstrated a beta version of the terminal emulation software that should be available by the time this review is published. The beta performed 50 percent faster than the current version, although it was still 40 seconds slower than the Attachmate *Extra!* file transfer record.

The large-block throughput tests proved that the Banyan system does well transferring large blocks of data to and from the mainframe. But another test showed that the Banyan system is inefficient in handling small data blocks. This means that if your application involves a lot of small blocks—database record updates, for example—you might want to test-drive the Banyan system carefully before you buy.

HELPFUL SUPPORT

The Banyan technical support center may be one of the best in the business. Fifteen support people are regularly on-duty Monday through Friday (8 A.M. to 8 P.M. eastern time), with five extra employees on call for those really tough questions. If you require late-night help, you can even get beeper service, although that adds to the \$1,895 basic service charge. (Banyan expects to lower prices early this year.) Banyan boasts that it makes an immediate response to 75 percent of calls; the other 25 percent are answered within the next 30 minutes.

The Banyan system has a lot going for it, not the least of which is excellent technical support. While some users' special considerations may mean that this system is not their best choice, others will find that it serves their needs well.

DCA IRMALAN

Digital Communications Associates (DCA), the company that brought you IRMA and IRMAII, also markets a networked 3270 emulator for token-ring—*IRMALAN* (\$995 for five users). The product, cousin to the well-known

3270 *IRMALAN* SNA package, is the easiest to configure of all the terminal emulation software we reviewed.

You install *IRMALAN* by loading the files from the distribution disks into a shared subdirectory on the file server, then downloading the configured software to the individual workstations—a 2-minute process.

Configuring the software is simple enough. Just page through the options and make your selections. Built-in function

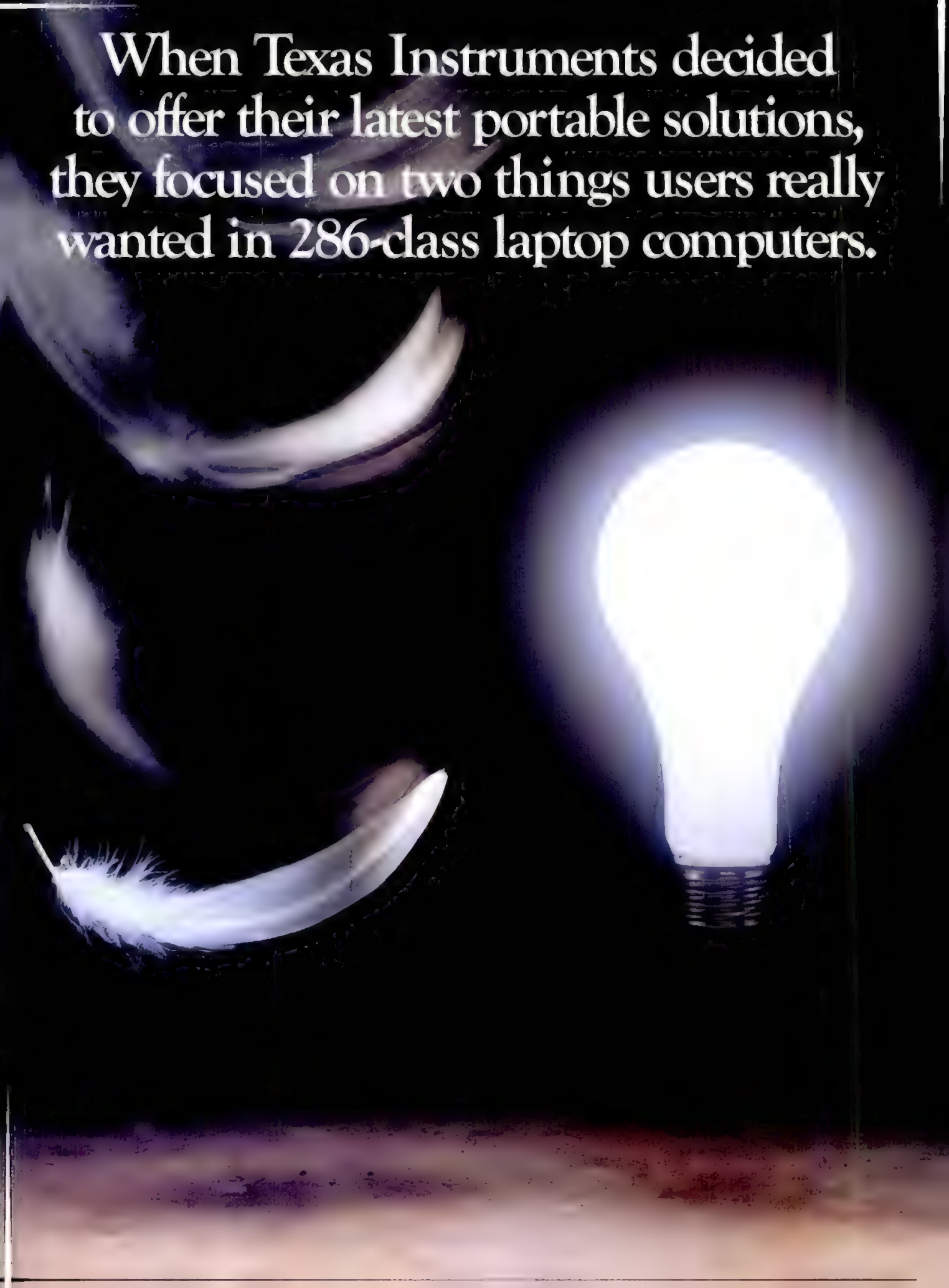
key shortcuts let you speed through to different pages of the configuration menu. Like all the other configuration menus we looked at (with the notable exception of IBM), there is no on-line help.

Loading the terminal emulation software into the workstation uses a whopping 248K RAM. The good news is that DCA *IRMALAN* includes an option that lets you load the software into expanded memory. Furthermore, you can slim the program down by 60K by executing the stand-alone workstation program *without* printer sessions.

DIRECT TOKEN-RING CONNECTIONS: SUMMARY OF FEATURES					
	Banyan 3270/SNA Option	DCA IRMALAN	Extra!	NetWare 3270	Personal Communications/ 3270
GENERAL FEATURES					
Supports PS/2s	☐	☒	☒	☒	☒
Supports IND\$FILE	☒	☒	☒	☒	☒
Supports APL	☐	☒	☒	☒	☐
CUT or DFT protocol	CUT	DFT	Both	Both	DFT
Windowing	☐	☐	☒	☐	☐
Electronic notepad	☐	☐	☒	☐	☐
Maximum block size	32K	2K	32K	2K	32K
Background file transfer	☒	☐	☒	☐	☐
Maximum number of sessions	4	5	4	5	8
System software recovers automatically from abends (abnormal terminations)	☒	☒	☒	☐	☒
Error messages in plain English	☒	☐	☒	☐	☒
Can run a DOS application as another session	☒	☒	☒	☐	☒
PRINTING					
Printer emulation included	☒	☒	☒	☒	☒
Supports parallel ports	☒	☒	☒	☒	☒
Printing to disk possible	☒	☒	☒	☐	☐
HARDWARE					
Supports EGA and VGA adapters	☐	☒	☒	☒	☒
Supports plotters	☐	☒	☒	☒	☒
Supports slide generators	☐	☐	☒	☒	☒
RAM used for terminal emulation	50—70K	248K	81K	189K	188K
Can unload terminal emulation	☒	☒	☒	☒	☒
Extended memory load option	☐	☐	☐	☐	☐
Expanded memory load option	☐	☒	☒	☐	☐
Requires CONFIG.SYS device drivers	☒	☐	☐	☐	☐
Keyboards					
Models supported	PC, AT, Enhanced, 3270	PC, AT, 3191, IRMAkey, Key Tronic	PC, AT, Enhanced, 3270	PC, AT, Enhanced, Key Tronic	PC, AT, Enhanced, 3270
Keyboard can be remapped	☒	☒	☒	☒	☒
Templates included	☐	☒	☒	☒	☒

—Editor's Choice ☒—Yes ☐—No

When Texas Instruments decided to offer their latest portable solutions, they focused on two things users really wanted in 286-class laptop computers.



Light.

TI introduces the TravelMate™
Full-function AT-compatible, featuring two o

Model 12: All the power — half the weight.

Weighing a remarkable 6.7 lbs. — including battery and 20 MB hard disk drive — TI's TravelMate LT286 Model 12 delivers all the processing power of a desktop PC in a laptop. It's the perfect choice for professionals who need to work on-the-go.

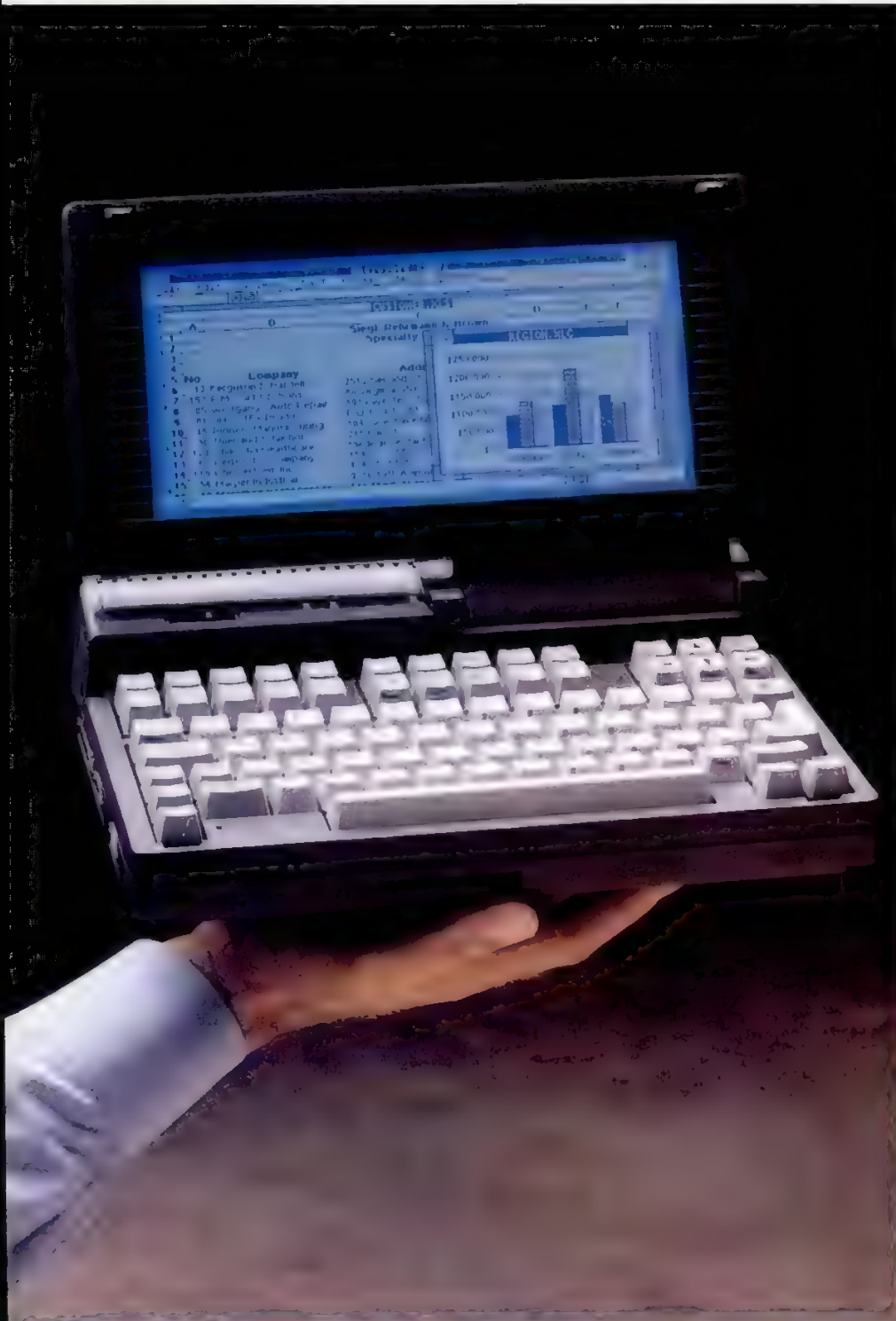
Getting started couldn't be easier. That's because the Model 12 has MS-DOS 3.3® and LAPLINK™ in ROM. It also comes with a preformatted disk drive, making it ready to use right out of the box.

With the Model 12, you don't sacrifice performance for small size and weight. Business software runs fast, thanks to a 12 MHz 80286 microprocessor. There's plenty of storage for all kinds of software applications — the internal hard disk drive comes standard. Plus, you get 1 MB of RAM, expandable to 4 MB.

Not only does the Model 12 perform like a desktop PC, it has the same touch. The AT-style keyboard provides full-size, full-travel keys that give your fingers plenty of room.

Other features include an easy-to-read, enhanced Supertwist backlit LCD screen. A removable 3.5" high-density diskette drive provides additional flexibility and convenience — snap it on for loading software or remove it and travel light. And, sending critical work to your office takes only a phone call with an internal modem.

The TravelMate LT286 Model 12: the laptop that doesn't compromise performance for size.



The removable 3.5" high-density diskette drive and internal modem are optional.

Bright.

LT286 Series of laptop computers.
the industry's lightest, brightest portable solutions.

Models 25 and 45: Dazzling display for windowing and graphics.

If you want portability and an exceptional display for graphics, you'll appreciate the bright side of this solution. TravelMate LT286 Models 25 and 45 feature a brilliant black-on-white VGA display that rivals that of most desktop PCs.

This makes text easy on the eyes and provides crisp, well-defined graphic images for applications that use MS® Windows, like PageMaker® and Excel™. The VGA screen is perfect for presentations to clients and prospects, plus your own personal use.

Not only do you get a superb display, you get superb performance as well. Like standard AT-compatible desktop PCs, Models 25 and 45 operate with a 12 MHz 80286 microprocessor for quick and powerful processing. You also get a 20 MB or 40 MB internal hard disk drive; an internal 3.5" diskette drive; 640K of RAM, expandable to 3.64 MB; an AT-style keyboard with full-size, full-travel keys; and an internal battery.

In addition, an intelligent power management system turns off the screen and fixed disk drive during periods of inactivity to extend battery life, allowing you to use the laptop longer.

Considering all these features and the performance and versatility they deliver, why would you ever need a desktop PC?

For computing on-the-desk or on-the-go, it's TravelMate LT286 Models 25 and 45: the 286-class laptops that combine might with bright.



Two decades of portable solutions add up to lighter, brighter solutions.

Twenty years ago, TI introduced the world's first portable data terminals. Today, with nearly a million units sold, we've established ourselves as a market leader by offering products that increased

in functionality and decreased in size.

This unparalleled experience has enabled us to provide you with the TravelMate LT286 Series — laptop computers that are powerful, innovative

and durable. Qualities you have come to know and expect from TI. The choice for lighter, brighter portable solutions.

For more information, call TI today. 1-800-527-3500.

SILENT 700, MODEL 725
1971

SILENT 700, MODEL 735
1974

SILENT 700, MODEL 745
1975

SILENT 700, MODEL 707

TRAVELMATE LT286 SERIES, MODEL 12
1989

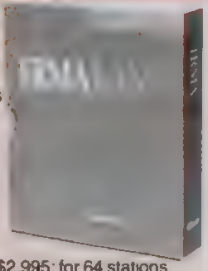
TRAVELMATE LT286 SERIES, MODEL 25 45
1989


**TEXAS
INSTRUMENTS**

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PC FACT FILE



DCA IRMALAN
Digital Communications Associates Inc., 1000 Alderman Dr., Alpharetta, GA 30201; (404) 442-4000
List Price: \$395 per station, for 5 stations, \$995; 802.2 Gateway Server, for 16 stations, \$2,995; for 64 stations, \$4,995
Requires: DOS 3.3 or later
In Short: DCA has the most elegant network configuration but lacks documentation on how to configure your system on the mainframe side. When using the IBM INDSFILE interface, file transfer is fast. Copy protected.

CIRCLE 407 ON READER SERVICE CARD

FILE TRANSFERS AND GRAPHICS

DCA file transfer software comes in different flavors to support a variety of mainframe operating systems and utilities. We performed our file transfer test using the FT/3270 program in conjunction with IBM's INDSFILE. While its throughput time was not as fast as the scores that were achieved by the IBM and Attachmate products, it beat the pants off Novell and Banyan.

The DCA software can display screens created by mainframe programs using APA (all points addressable) and GDDM (Graphical Data Display Manager, Version 1.4.0 or later) graphics standards. The list of devices supported by DCA's APA graphics is long. The graphics configuration process requires you to respond to questions about your display adapter, input devices, and math coprocessor. Printers, plotters, and graphics cameras are supported.

You can also create output files in either .PIF or .CGM (Metafile) formats; moreover, .CGM files can be translated to the .PIF file format through the Recall utility program.

The software package comes with the requisite keyboard templates (in fact, the keyboard layout for IRMA has become an industry standard for other micro-to-mainframe terminal emulation software). You can also remap the keyboard keys to suit your personal taste.

DCA also offers an 802.2 gateway support package, which costs \$2,995 for 16 sessions and \$4,995 for 64 sessions on one server. The gateway package offers some features that are not found in the direct token-ring connection program, including

the use of pooled or dedicated sessions and session management tools.

DOCUMENTATION AND SUPPORT

The documentation for *IRMALAN* is well written but lacks information on how to set up your system on the mainframe side. It does reference helpful IBM manuals, though, such as the Control Unit, DOS, and the IBM 3270 Information Display system. You'll need to keep DCA's user guide handy, too, since program error messages are displayed as symbols rather than in plain English.

In the product's favor are simple installation, good transfer speed, and expanded memory support. While its documentation could be improved upon and its toll-free support number (recently discontinued) is certainly missed, the package still rates as a decent buy.

Extra!

Attachmate's *Extra!* makes a good first—and lasting—impression with its design and implementation. Those behind this \$425-per-workstation package show a keen appreciation of system architecture. For example, the software uses the information generated when it binds with the mainframe session to determine if the protocol is set up to transfer files using structured or unstructured fields. No other package we reviewed is clever enough to determine the file transfer protocol; most packages demand that you work with the mainframe system programmers to change mainframe session configurations to match their technique.

When it comes to actually transferring data, Attachmate's program sizzles with the fastest recorded time: 42 seconds for a 277-kilobyte file (54 kilobits per second). Since file transfer can also take place in background mode, you can work in DOS while the emulation software moves files.

EXCELLENT EMULATION

The terminal emulation software comes with an impressive list of standard features, including the HLLAPI, SRPI, and 3270-PC APIs. It allows mainframe-driven print jobs to operate in background mode, accessing printers attached to PCs. It also supports a wide range of terminals, including the Model 5, which displays 27

PC FACT FILE

EDITOR'S CHOICE



Extra!
Attachmate Corp., 13231 SE 36th St., Bellevue, WA 98006; (800) 426-6283, (206) 644-4010
List Price: \$425 per station.
Requires: DOS 2.1 or later
In Short: *Extra!* is well written and, unlike any other program, takes advantage of the system resources to help the user. The package contains excellent documentation and is backed up with good technical support.

CIRCLE 406 ON READER SERVICE CARD

lines by 132 columns of text. To reduce the amount of customization needed during the installation process, it automatically senses the type of video adapter in the PC.

Each mainframe session can appear in an on-screen window (four windows are available at one time) so that you can monitor the activity in one or more sessions while working in another. The product differentiates among session windows with variously colored borders.

As is the case with all the products we reviewed, the emulation software can be unloaded from memory. However, *Extra!* goes even further: you can also unload individual program modules from memory without disrupting the active terminal session. When resident, the package uses only 81K of RAM for one text mode session, so you have room left to do real work in DOS.

GRAPHICS SUPPORT

You'll need to order special packages to support vector or S3G graphics. The vector graphics package requires that you have either EGA adapters with 256K of on-board memory or VGA adapters. For S3G graphics, you'll need either an EGA adapter with 128K of on-board memory, a VGA adapter, or AT&T's Display Enhancement Board.

In addition to the 81K used by the basic terminal emulation software, be prepared to give up some more RAM to graphics sessions. The amount of additional memory required varies with the number of sessions and the type of data presented in the screens. According to Attachmate's own formula, one vector graphics session using a single Display List and Symbol Set takes an additional 58K of RAM.

It's a brand New Year



Bitstream ... NCP

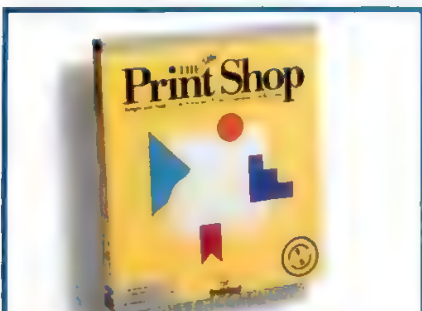
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- CP—copy-protected; NCP—not copy-protected.

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SOFTWARE

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Broderbund ... CP

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- Alpha Software ... NCP
- 5104 ☐ ALPHA/four 1.0 319.
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- 1214 ☐ Pizazz Plus 1.3 69.
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- Autodesk ... NCP
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- 1447 ☐ FormTool 2.01 55.
- 4594 ☐ Form Filler 2.0 89.
- Borland International ... NCP
- 1498 ☐ Turbo C 2.0 105.
- 4330 ☐ Turbo C Professional Pack 1.0 175.



Chipsoft ... NCP

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- 1514 ☐ Paradox 3.0 call
- Bourbaki ... NCP
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- 5408 ☐ Hyperpad 1.0 89.
- 5843 ☐ Show Partner F/X 3.5 229.
- Broderbund ... CP
- 1434 ☐ New Print Shop 39.
- 1433 ☐ Memory Mate 3.01 (NCP) 45.
- Caere ... NCP
- 6004 ☐ Omnipage 386 2.0 599.
- Central Point ... NCP
- 5039 ☐ PC Tools Deluxe 5.5 77.
- 5038 ☐ Copy II PC 5.0 27.
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- 1663 ☐ TurboTax for 1989 Taxes 7.0 45.
- ☐ Individual States (avail. 1/90) each 34.

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- 5506 ☐ Corel Draw 1.1 \$329.
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- 2911 ☐ Remote 2.0 109.
- 2908 ☐ Crosstalk XVI 3.7 109.
- 5611 ☐ Crosstalk for Windows 1.0 129.
- DacEasy ... NCP
- 1756 ☐ Dac Easy Payroll 4.0 59.
- 1748 ☐ Dac Easy Accounting 4.0 89.
- Data Storm ... NCP
- 4798 ☐ PROCOMM PLUS 1.1 52.
- Delrina Technology ... NCP
- 4325 ☐ PerFORM 2.0 169.
- Delta Technology ... NCP
- 5829 ☐ Direct Access 4.1 52.
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- 5876 ☐ db Publisher Report Maker 2.0 . 185.
- 5th Generation ... NCP
- 5504 ☐ Brooklyn Bridge 3.0 79.
- 4688 ☐ Mace Gold 1.0 89.
- 3950 ☐ Fastback Plus 2.09 109.
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- 5810 ☐ FormWorx System 2 1.0 169.
- Fox Software ... NCP
- 6188 ☐ FoxPro 1.0 489.
- Funk Software ... NCP
- 2228 ☐ Sideways 3.21 42.
- 4479 ☐ Allways 1.0 85.
- Generic Software ... NCP
- 2265 ☐ Generic CADD Level 3 1.13. ... 169.
- Great American Software ... NCP
- 4880 ☐ One Write Plus Accounting Sys. 2.0 .179.
- 5825 ☐ Money Matters 1.0 55.
- Harvard Associates ... NCP
- 2324 ☐ PC Logo 3.0 59.
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- 2293 ☐ Smartcom II 3.0 89.
- Hilgraeve Software ... NCP
- 2323 ☐ HyperACCESS/5 1.0 (DOS & OS/2) 115.
- IBM ... NCP
- 6187 ☐ Storyboard Plus 2.0 239.
- 6186 ☐ DisplayWrite 4 2.0 249.
- Individual Software ... NCP
- 2408 ☐ Professor DOS 4.0 27.



Corel Systems ... NCP

- ☐ **Corel Draw 1.1**—PC Magazine called it "A walloping good freehand drawing program that is easy to learn and fun to use. Highly recommended." \$329.

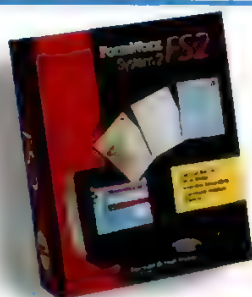
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2426	Quicken 3.0	\$39.
Lord Publishing ... NCP		
5191	Ronstadt's Financials 1.02	145.
Lotus ... NCP		
5417	1-2-3 3.0	call
5653	1-2-3 2.2	call
5134	Magellan 1.0	149.
4131	Agenda 1.0	275.
2660	Freelance Plus 3.01	345.
MECA ... NCP		
4603	Tax Cut for 1989 Taxes	49.
2798	Managing Your Money 6.0	119.
Microcom ... NCP		
2775	CarbonCopy Plus 5.1 (2 req.)	115.
Micro Logic ... NCP		
2968	Tornado 1.8	55.
Microlytics ... NCP		
2731	GOfar 2.0 (new version)	45.
Microrim ... NCP		
2835	R:BASE for DOS (version 2.1)	489.
Microsoft ... NCP		
2860	Learning DOS 2.0	35.
2899	Windows 286 2.1	69.
2904	Works 2.0	99.
2900	Windows 386 2.1	129.
2901	Word 5.0	209.
6195	Word for Windows	329.
2856	Excel 2.1 (req. 80286/80386)	call
6033	Excel for OS/2 1.0	339.
5188	QuickPascal 1.0	69.
2894	QuickBASIC 4.5	69.
2895	QuickC 2.0	69.
5410	QuickC 2.01 w/Assembler	139.
2853	QC Compiler 5.1	299.
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4925	PC-Kwik Power Pak 1.5	79.
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2970	Clipper (Summer '87)	429.
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4337	GB-Stat 1.5	159.
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3142	VP-Planner 3D 1.0	169.
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3152	Norton Commander 3.0	89.
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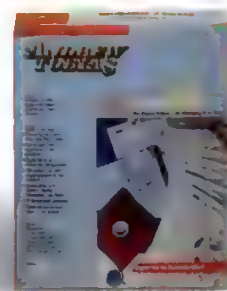
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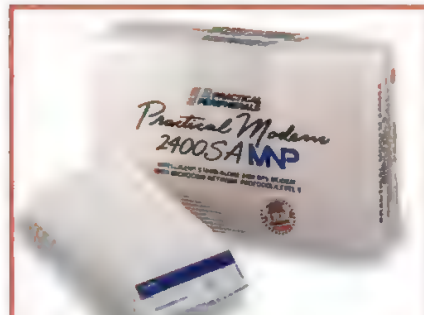
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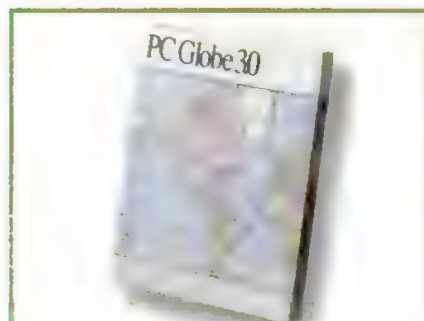
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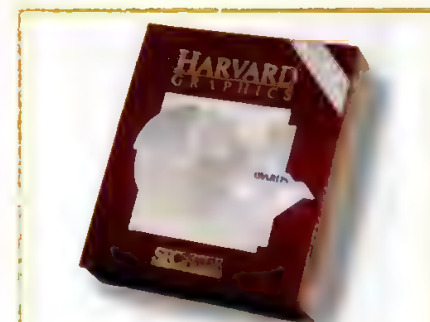
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ALTERNATIVES TO DIRECT TOKEN-RING ATTACHMENT

by Frank J. Derfler, Jr.

The direct token-ring connection scheme has elegant simplicity: Every PC talks to the mainframe as a peer. There is no need to use wiring adapters or to establish specialized gateway machines on the network. However, the costs for the token-ring network and the TIC-equipped mainframe hardware with sufficient polling power can be very high.

Establishing a network gateway has two major advantages over the direct token-ring connection: since the gateway is a single Physical Unit, mainframe polling is reduced; also, you can use LAN types other than the token-ring to link the PCs to the gateway.

A secondary advantage of a gateway is that it serves as a centralized point for security control, management, and troubleshooting. Of course, any centralized control point is potentially a single critical point of failure, too.

Today, a typical gateway uses a relatively slow SDLC link to connect to the mainframe hardware suite. But there are two other gateway-to-mainframe connection schemes you should consider: token-ring (IEEE 802.2) and IBM 3299 multiplex.

The token-ring gateway (DCA and others call it an 802.2 gateway in deference to the IEEE standard) links the gateway PC and mainframe over a token-ring network. The mainframe element is TIC-equipped, and the PC gateway houses one or possibly more network adapter cards. One card or cards connect the gateway to the network stations over Ethernet, ARCnet, token-ring, or any other wiring scheme. Another LAN adapter card in the gateway PC makes the token-ring connection to the TIC. You might establish a

PC token-ring to mainframe token-ring gateway in order to reduce the number of Physical Units polled by the mainframe.

Attachmate, Banyan, DCA, IBM, and Novell either market separate 802.2 gateway products or include 802.2 gateway capabilities in their direct token-ring attachment packages. These are priced in different ways. DCA charges \$2,995 for a 16-session 802.2 gateway (the price includes the terminal emulation software), while IBM includes both direct and gateway capabilities in its \$475-per-station Personal Communication/3270 package.

You have to add the cost of the PC acting as a gateway, but even an unloved 4.77-MHz PC can do the job. The cost of the TIC-equipped mainframe components varies widely depending on what equipment you want to use, how you get support, and how you buy the equipment.

FOR THE TIC-LESS

But if you don't have TIC-equipped mainframe components, there is still a gateway alternative that offers a high-throughput link to the mainframe.

Several companies market gateways that emulate IBM 3299 coaxial multiplexers. The real IBM 3299 coaxial multiplexer is designed to make it easier to connect a group of terminals to a mainframe over several thousand feet of cable. The multiplexer combines the data from eight coaxial cables onto one cable to reduce the cost of wiring.

Each terminal cluster controller in IBM's latest series (the IBM 3174) has one of its four primary channels configured for an IBM 3299 connection. You can upgrade terminal cluster controllers economically with a microcode change

to give 3299 service.

When a gateway PC on a network emulates a 3299 with appropriate software and a special coaxial adapter card, it uses a high-speed connection to the IBM 3174. The gateway can distribute up to 40 simultaneous mainframe sessions to its attached PCs running terminal emulation software. Our testing showed that the 3299 gateway architecture attains the same or better throughput as the token-ring connection at a potentially much lower cost.

Companies that market 3299 hardware and software include Data Interface Systems (P.O. Box 4189, Austin, TX 78765; (800) 351-4244); Information Technologies Inc. (14505 N. Hayden Rd., Scottsdale, AZ 85260; (800) 431 3460); ICOT Corp. (3801 Zanker Rd., P.O. Box 5143, San Jose, CA 95150; (408) 433-3300); and Novell. These products, including Novell's, work over any network with NetBIOS services. Several companies price these packages on a per-station basis. This pricing scheme can potentially provide 3299-connected service for \$100 per station or less—plus the cost of a PC for the gateway.

GATEWAY QUALITIES

There are many options you can look for in gateway systems, including pooled sessions, sessions divided by groups of users, security controls, and trace/dump utilities. All these companies have good management packages with varying abilities to audit and retire unused mainframe sessions and control the use of resources.

The direct token-ring attachment architecture certainly does not signal the end of gateways. The competition seems to have made them better. ■

Both the Vector and S3G graphics modules come with ZSoft's *PC Paintbrush* FRIEZE interface to capture graphics from the mainframe, as well as Attachmate's own image-capture program. The Vector Graphic software package supports up to 18 printers and 10 plotters; the S3G package supports only two printers and no plotters.

TECHNICALLY SUPPORTIVE

Attachmate has some of the best technical documentation in the industry. The Setup and Reference manual contains clear answers to the questions that mainframe programmers will ask when you attempt to integrate with the mainframe. You also get helpful comparisons of setup configurations that include the pros and cons of op-

eration and memory usage, as well as a well-written user's manual that has important information on the terminal emulation and options.

Additional help is supplied via a 3270 keyboard terminal emulation template. Software options include predefined keyboard layouts used in the IBM and DCA IRMA terminal emulation products.

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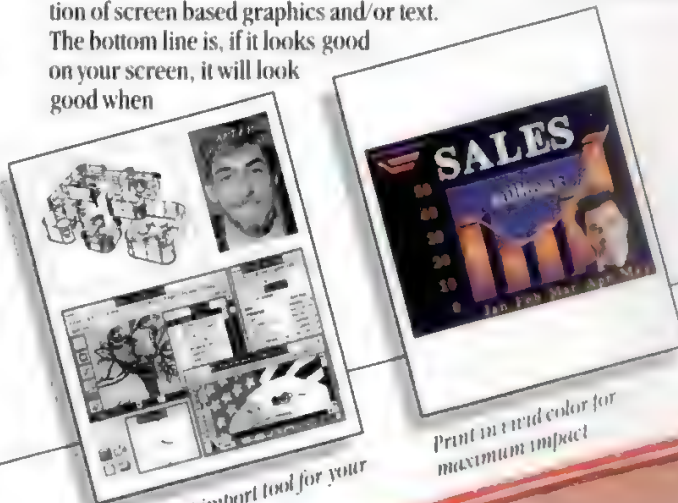
Adobe Systems, Acer, Alps, AMT, Anadex, Apple, AST, AT&T, Brother, C. Itoh, Calcomp, Canon, Centronics, CIE, Dataproducts, DEI, Diablo, Dicom, Epson, Genicom, Hewlett Packard, IBM, IDS, Infocube, JDL, Kocera, Laser Connection, Mannesmann Talb, NEC, Newbury Data, Oasys, Okidata, Panasonic, Printronix, QMS, Quadram, Qume, Seikosha, Sharp, Star Micronics, Tandy, Tektronics, TI, Toshiba, Transtar, Unisys, Xerox, Wang

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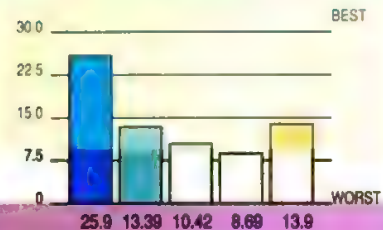
PERFORMANCE TESTS: DIRECT TOKEN-RING CONNECTIONS

Connecting PCs and mainframe systems over a token-ring LAN provides fast throughput—in some cases ten times as

fast as what we've measured for SDLC-attached gateways in previous tests on the same hardware.

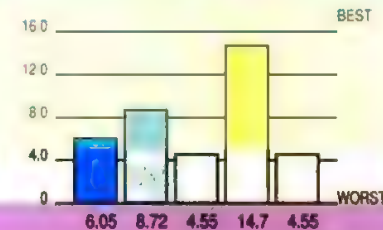
MAINFRAME-TO-TERMINAL
(LARGE BLOCK)

One Station Throughput*



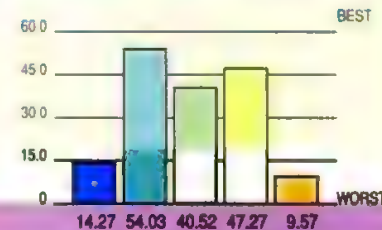
MAINFRAME-TO-TERMINAL
(SMALL BLOCK)

One Station Throughput*

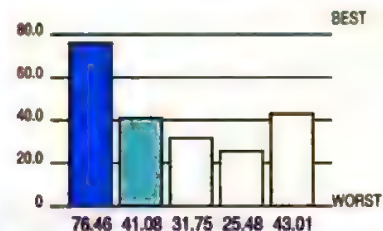


FILE TRANSFER

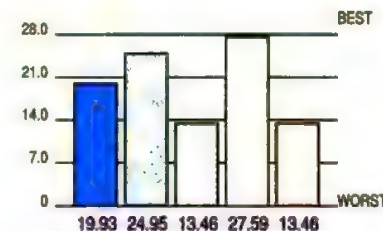
File Transfer Throughput*



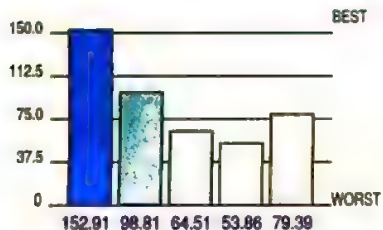
Three Stations Throughput*



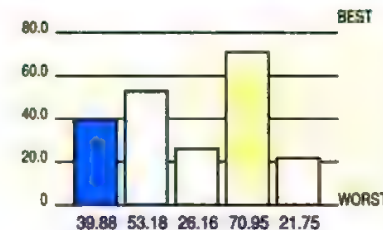
Three Stations Throughput*



Six Stations Throughput*



Six Stations Throughput*



The File Transfer test moves a relatively large 277K file from the mainframe to the PC using IBM's IND\$FILE editor utility. Other proprietary mainframe programs are likely to have faster transfer rates, but IND\$FILE is ubiquitous.

The throughput reported in these tests is measured at the mainframe and is an aggregate for all the active terminals. The mainframe, an IBM 3084 made available by Harris Corp. of Melbourne, Florida, was not loaded with any other functions. It was configured under IBM's Extended Architecture and ran under IBM's Virtual Machine High-Performance Option. The TIC connection went to an IBM 3174L terminal cluster controller. IBM PC-XTs were used as workstations.

Each PC acting as a terminal made continuous screen buffer and display requests, simulating the activity of a dozen or more terminals in normal operation.

The Mainframe-to-Terminal (Large Block) throughput test measures the total amount of data the terminals accept from the mainframe in a 5-minute period, yielding an average throughput figure in kilobits per second. In this test, the data moves in 6,144- and 8,192-byte blocks—sizes that simulate large-record data queries and updates. The test is run on LAN test-beds of one, three, and six stations.

The Mainframe-to-Terminal (Small Block) throughput test also measures the total amount of data the terminals accept from the mainframe in a 5-minute period. This time the data moves in 512- and 1,024-byte blocks—sizes that simulate data entry and updates in small fields. The test is run on LAN test-beds of one, three, and six stations.

* Kilobits per second.



TOKEN-RING PERFORMANCE TESTS: COMPOSITE VIEW

(Taller bars represent better performance)

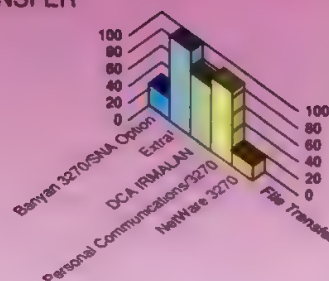
Though the five tested products varied in their ability to move large and small blocks of data, these performance tests show that even under loaded conditions, PCs acting as terminals will receive fast screen displays and yield reasonable throughput for file transfer.

The small-block test scores are particularly important to people in a data entry environment. IBM's *Personal Communications/3270* was the clear performance champ on this test, even though it lagged behind the others in the large-block test.

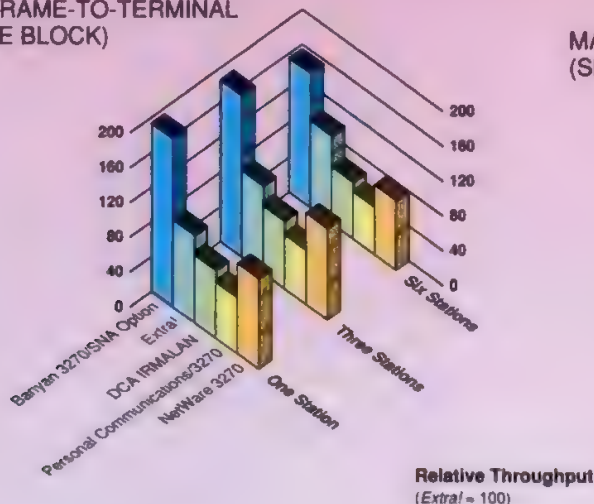
The large-block test simulates conditions more typical of mainframe graphics or word processing applications. Here, *Banyan 3270/SNA Option* was the top performer, with *Attachmate's Extra!* and *Novell's NetWare 3270* coming in just about tied for second.

For straight file transfer, however, the Editor's Choice *Extra!* was the obvious winner, running more than five times as fast as the last-place *NetWare 3270*.

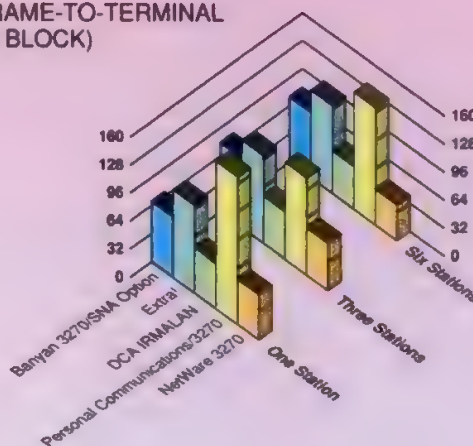
FILE TRANSFER



MAINFRAME-TO-TERMINAL (LARGE BLOCK)



MAINFRAME-TO-TERMINAL (SMALL BLOCK)



Support is free and available via a toll-free number. For an additional \$50, you can get the appropriate software that lets you connect one of your PCs to its 802.2 gateway. Ethernet LAN users will be happy to know that the workstation emulation software itself includes the Arbitrator, a program that translates your protocol to 802.2.

Attachmate has done a fine job on *Extra!*. The benefits of flexible options and good technical support make an already excellent product even better.

NetWare 3270

Novell has something for everyone interested in making PC-to-mainframe connections over token-ring. If you want to connect just a few PCs to TIC-equipped IBM mainframe equipment, the product we re-

view here—*NetWare 3270* (\$475 per workstation)—is one to consider.

However, with such a wide-ranging product line, some of Novell's other options are worth mentioning. If you want to connect more than eight PCs to a mainframe over token-ring, a more economical investment is the \$3,995 *NetWare 3270 Token-Ring Server Option*, a package that lets you connect up to 100 workstations. And if you don't want to wire the whole building for token-ring, you can establish a token-ring gateway system using the \$2,995 *Novell SNA Gateway* software. You'll also need the \$995 *LAN 3270* workstation software (bundled free with *SFT NetWare*), which accommodates up to 97 3270 workstations on one network.

MAKING CONNECTIONS

NetWare 3270 is easy to install and well documented. The instructions, which do a very good job of explaining micro-to-

mainframe connections, include information for both the PC network manager and the mainframe systems programmer. You also get worksheets that help you configure remote, high-speed remote, token-ring, coaxial, and coaxial multiplexer (coaxmux) connections.

The complete package includes the terminal emulation portion of the software and various drivers, as well as file transfer and Novell utility programs. In addition to its coaxmux abilities, the software offers capabilities for SDLC links and 802.2 gateways.

It's easy to load and configure the software from one location. We installed it by copying the files to the server and then downloading them to the individual workstations.

The configuration process is menu-driven and allows you to specify options for APL support and keyboard size, as well as to select one of the 29 different na-

CONNECTIVITY

TOKEN-RING TO MAINFRAME

TRFORMAT, which copies the contents of memory locations into a binary file, and TRDUMP, which translates the binary file into ASCII format. One of the best things about trace is that even after a warm boot, it is still present in memory.

The 3270 Vector Graphics option requires that you have an EGA or better video adapter with 256K of memory. Saving a graphic image on the host is done by jumping back to the PC session and executing VGPIFSV, using parameters specifying path and graphic filename. Graphic files default to the .PIF format, which is incorporated into many imaging applications. The wide range of output choices includes 45 printer and 20 plotter drivers.

The Novell package also includes a keyboard template that shows how to use the PC's keys to emulate those on a 3270 terminal.

Novell's technical support is thoroughly knowledgeable about both the PC and mainframe ends of the token-ring product. Problems and questions are answered within a 4-hour turnaround time. The support line is open from 9 A.M. to 8 P.M. eastern time, Monday through Friday, and there is no charge to end users or resellers.

While *NetWare 3270* suffers from a few problems, Novell's high-quality documentation, knowledgeable technical support, ease of installation, and generally good performance are commendable. Additionally, you get the sense of security that comes from dealing with a well-known and reputable company.

Personal Communications/3270

IBM's *Personal Communications/3270* package, developed by Big Blue's Hersly, England, division, has more standard features and fewer add-ins than the gateway product we reviewed a year ago. Instead of the one session supported by the previous version of the program, you can now have up to eight sessions configured any way you like. Additionally, the package also now includes an impressive log-in script feature.

Like the older package—the IBM *PC3270 Emulation Program*—the newer system includes the application program interface for IBM's Server Requester Pro-



FACT FILE

Personal Communications/3270
IBM Corp.; contact your local authorized IBM dealer; (800) IBM-2468, ext. 141.
List Price: \$475 per station.
Requires: DOS 3.3 or later.
In Short: IBM improves its emulation software by leaps and bounds. *Personal Communications/3270* includes both direct token-ring connection and token-ring gateway connection options.

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gram, the only API that both the old and the new share in common. (Note: IBM will support the *PC3270 Emulation Program* only through July of 1990.) At \$475 per station, the *Personal Communications/3270* program also includes 802.2 token-ring gateway support; there's no extra cost to use the software in direct token-ring or token-ring gateway attachment schemes.

LESS-THAN-SPEEDY INSTALLATION

IBM-developed PC communications products are never as easy to install as the competition's are. True to form, installing the 3270 software on the network was an involved and time-consuming process.

For one thing, you cannot load the software into a subdirectory on the server and then download it to each individual PC. Instead, you must carry the six disks to every PC and do the installation on each machine.

The configuration of the product on one machine took about 8 minutes from start to finish. Luckily, the configuration menu offers on-line help that explains in detail the parameters needed to complete the installation. Keep in mind that once installed, you need the setup disk to change any configuration parameters.

The documentation is good. We particularly enjoyed a section called "Who You Should Know," which clearly describes the people inside and outside the mainframe computer room you need to talk to before installing a LAN gateway. The manual also includes worksheets to help you plan the software configuration.

USING THE SYSTEM

The Auto-Log-on facility is a handy little utility that lets you create a script file to



FACT FILE

NetWare 3270
Novell Inc., 890 Ross Dr., Sunnyvale, CA 94087; (800) 221-6402, (408) 747-4000.
List Price: \$475 per station. *NetWare 3270 Token-Ring Server Option* for 100 stations, \$3,995.
Requires: DOS 2.1 or later.
In Short: Novell offers many options in its *NetWare 3270* product, and all the software, with the exception of the IND\$FILE file transfer program, works well. An alternative to that program is available.

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tional keyboard character sets. If you load the program using the /D parameter, you get one extra configuration screen that includes options for changing the internal stack, heap and trace sizes, and screen buffer handling. Increasing these buffers increases the total amount of RAM used for terminal emulation. The typical installation takes up 106K of RAM per PC; when we increased the number of buffers to handle testing, the package used 146K of memory.

You don't need NetBIOS or IPX network driver programs loaded in memory to operate the 3270 terminal emulation. The token-ring device drivers are loaded from the CONFIG.SYS file at bootup, so the emulation is ready to go.

In general, *NetWare 3270* handles nicely, except when used with old XTs and CGA adapters. This hardware combination caused snow on the screen, even when we chose the snow suppression option in the configuration setup. The majority of the other terminal emulation packages reviewed did not show snow on any hardware.

In the file transfer arena, Novell includes software that uses IBM's standard IND\$FILE mainframe program. Novell also markets a \$395 mainframe package called NVL\$FILE designed to work specifically with its software. Using IND\$FILE, Novell's transfer time was one of the slowest of all the packages we tested. (We didn't test NVL\$FILE.)

OTHER OPTIONS

The program includes a variety of options, such as a trace facility, APA (all points addressable) graphics, and APL support. The trace facility consists of two programs:

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TOKEN-RING TO MAINFRAME

systems. However, ownership does not a champion make. In the File Transfer test, IBM beat out experienced competitors like DCA and Banyan but came in second to *Extra!*.

Being the biggest means never having to support the other guy's hardware. As is typical for IBM programs, the graphics package specifically supports only IBM printers and IBM plotters, though if you have a compatible output device, you should be able to see some hard copy. IBM does run tests on hardware and software currently standard in the industry, and we easily obtained instructions on using Hewlett-Packard plotters.

SUPPORT SERVICES

Unfortunately, the only way to get support from IBM is to get an access code from or sign a maintenance agreement with an authorized dealer—not good for quick fixes. IBM problem solvers diligently work every Monday through Friday, 8 A.M. to 5 P.M. eastern standard time. Support is available via a toll-free number.

IBM has an interesting way of routing technical support calls. It asks your organization to assign a priority rating to its ques-

tions, with "1" being severe, and "4" usually standing for information that's just "nice to know."

The IBM Personal Communications/3270 token-ring connection has a few weak points, lengthy installation and lack of expanded memory support among

product goes beyond working just right: it actually gleans information from the hardware to make your life easier as you configure your system. The technical support is free, and the response time is fast.

IBM's product, *Personal Communications/3270* Token-Ring connection, comes in second. Popular even in its earlier incarnations, it has been substantially improved and gives good value for the price, but doesn't yet have all the features of the Attachmate product.

EDITOR'S CHOICE

• Extra!

The Editors Choice doesn't always go to the fastest or best-selling product. Price, overall performance, and quality always figure into the equation. In this case, Attachmate's *Extra!* is the clear winner.

Extra!'s RAM requirement is the smallest of any of its competitors, 100K to 150K less than that of some of the others. At the same time, the data transfer rates it achieves between the PCs on the LAN and the mainframe are tops in the field. The

them. However, snappy features like the auto-log-on facility, on-line configuration help, and respectable speed make this product a worthwhile contender. ■

Randol Tigrett is a project leader at PC LAN Labs.



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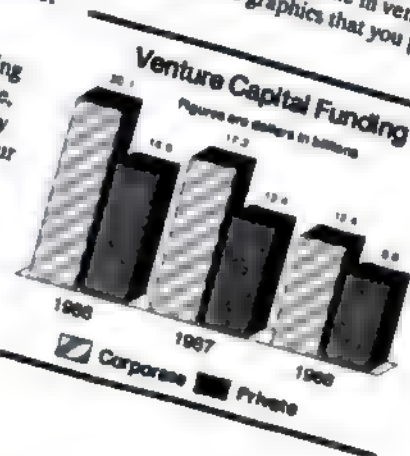
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Vice President
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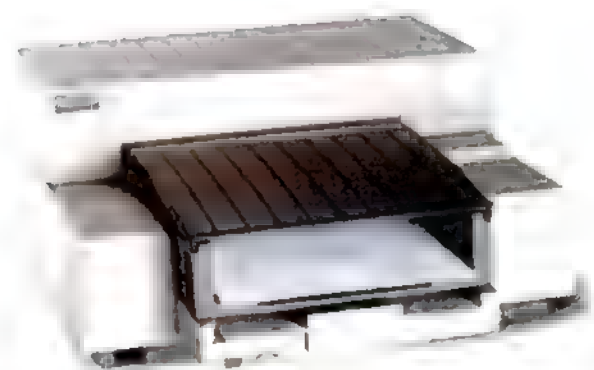
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CASE Tools for Designing Your Applications

by Henry Fersko-Weiss

The PC CASE market is growing and maturing. Today's second-generation design and analysis tools will help you create better programs that are easier to maintain.



PC software has automated countless business processes and tasks over the past decade, but it's only in the last few years that PC packages have been developed to automate the software development cycle itself. Using software to develop software is what CASE (computer-aided software engineering) is all about. CASE tools prove that the software industry can practice what it preaches.

CASE tools for the PC are very young. *Excelerator*, one of the earliest CASE tools and now the best-seller, was introduced in 1984 by Index Technology. Even the concept of CASE is only about 15 years old. The information systems (IS) world has been somewhat slow to accept CASE. Unlike hard engineering disciplines—such as electrical or mechanical engineering—software engineering has long been considered an art as well as a science. IS departments have been reluctant to give up the power of their mysterious art to automation. And until recently, PCs weren't powerful enough to handle CASE. But as PCs grow more powerful, and as the backlog of in-house applications grows bigger, IS departments are beginning to open their arms—and their coffers—to the new wave of CASE tools that have recently surfaced.

Even now, CASE isn't much more than a topic for cocktail conversation at many companies. Estimates vary on market penetration, but it would seem to be 10 percent at best. Much of the work with CASE is experimental, and even at the most proactive user companies, CASE

has been adopted on a project or departmental basis only. But that's about to change.

A GROWING MARKET

The CASE market is expanding rapidly. Some analysts predict that it will grow at a rate of nearly 50 percent a year for the next four years, reaching an annual sales level of \$1.4 billion by 1993. Most analysts agree that by the mid-1990s, no software will be written without the help of a CASE tool.

For many people, the term CASE calls to mind code generators, which automate the back end of the software development process. But CASE products exist for virtually every phase of the software development life cycle. Front-end tools, which help with planning, analyzing, designing, and prototyping systems, are grabbing the lion's share of the CASE market. According to Input, a market research firm, front-end tools generated \$135 million in 1988—63 percent of the CASE market.

Last September, IBM announced its Application Development (AD)/Cycle, the strategy by which IBM will provide standard specifications to allow all application development tools to communicate amongst themselves, thus bridging the gap between front-end and back-end tools. Besides having purchased minority interests in two of the companies whose products are reviewed here (Index Technology and KnowledgeWare) to help with OS/2 development of its packages, IBM plans that any CASE developer will be able to operate in the AD/Cycle by writing SAA interfaces, and 32 companies have already signed on. The stamp of approval that IBM has given PC-based CASE is an important step forward.

RIGHT FROM THE START

Design and analysis CASE tools are getting most of the attention today because automating the front end of the software development life cycle yields tremendous productivity gains at every subsequent stage. If the analysis and design of a program are done well, maintaining it is a snap. Today, IS departments spend about 70 percent of their time maintaining programs. Anything that makes the maintenance process easier frees up developers to create new systems.

Today, there are well over 100 companies offering nearly 200 different front-end CASE tools. In this article, *PC Magazine's* first look at CASE, we've honed in

SOFTWARE

CASE

**CASE tools are getting
attention today
because automating
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software development
life cycle yields
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subsequent stage.**

on the best-selling design and analysis packages. To determine which products have the biggest market shares, we used figures from three market research firms: International Data Corp., Input, and Sentry Market Research.

BEST-SELLING CASE TOOLS

Our original intention was to cover all design and analysis products that account for at least 2 percent of CASE revenues. Some of the products that met this criterion didn't make it into the review: we did not receive *Foundation* from Arthur Andersen or *IEF* from Texas Instruments, because these companies offer consulting services and don't sell their products as standalones. *PACBASE* from CGI Systems and *SDM/Standard* from AGS Management Systems are not included here because each requires a mainframe as well as a PC.

One product we chose to include, *POSE*, is too new to have a significant share of the market, but we think it's an exciting alternative worthy of consideration. We've also included a look at one other new product: Syscorp International's *MicroSTEP*, the first PC product to combine code generation with some of the design and analysis stages.

The packages that get full-fledged reviews here are *Analyst/Designer Toolkit* from Yourdon, *Auto-Mate Plus* from Learmonth & Burchett Management Systems, *DesignAid* from Nastec Corp., *Accelerator* from Index Technology,

IEW/Analysis Workstation and *IEW/Design Workstation* from KnowledgeWare, *POSE* from Computer Systems Advisers, *ProKit*Workbench* from McDonnell Douglas, *teamwork* from Cadre Technologies, *Visible Analyst Workbench* from Visible Systems Corp., and *vsDesigner* from Visual Software.

METHODOLOGIES AND TECHNIQUES

Although none of the front-end CASE tools on the market today fully and rigorously incorporate a methodology, choosing a product that supports some aspects of the methodology your company already employs will help ease the transition to a CASE tool. A methodology is a complete set of rules and step-by-step procedures for the creation and organization of a software program. It is written down (some take up 18 volumes), can be taught, and is reproducible in project after project. In the realm of theory, methodologies are meant to be followed unswervingly, but in the real world, where business needs change seemingly at the speed of light, methodological steps get dropped and procedures shortened. In the business world, techniques play a more central role.

Design and analysis techniques are ways to view pieces of the development process, such as system requirements, the flow of data, and entity relationships. All of these techniques have associated diagrams. For example, the Gane/Sarson technique uses a data flow diagram to make a logical model of a system. The diagram has open rectangles to indicate data stores (databases), square boxes for external input or output, and boxes with rounded corners to indicate processes. The flow of information through this system is indicated by arrows. Other techniques might use a similar diagram with somewhat different representations.

These differences can be merely stylistic or more substantial. In a Ward/Mellor transformation graph, you might have the exact same data-flow elements with two additions: dotted-line boxes with rounded corners to indicate control transformations—that is, changes in input from machines such as automated tellers or point-of-sale terminals—and dotted arrows to indicate the flow of machine inputs and outputs.

PICTURES TELL THE STORY

In the early stages of software development, creating diagrams of data flow, structure, and entity relationships requires

80 to 90 percent of the developer's time. These diagrams make communication with end users much easier because the illustrations eliminate much of the elevated jargon of systems professionals. Pictures tell the story much better than words. Most of the diagrams are fairly simple because they reflect only one piece of the puzzle and generally only one level of detail. Diagrams are further exploded to reveal more-

The benefits of using a design and analysis tool are considerable, but they're mostly intangible. The most obvious benefit is better-designed software that will require less maintenance later.

detailed views of a system component. It's as if the software engineer were turning a knob to switch levels of magnification on a microscope. The CASE tools reviewed here all generate output in the form of such diagrams.

While the diagrams are the visual focus of front-end CASE tools, the data dictionary or repository is the real heart of these programs. Every data element, control input, and process is entered into the repository. Each is defined, described, and related to the others. The diagrams are produced from the information in the repository.

Another important output of design and analysis programs is system reports, which are also generated from the information in the repository. These reports tell the engineer whether the design is consistent; whether it contains redundant or overlapping data elements; whether processes are incorrectly connected to the data flow, are left dangling, or consume the data; whether or not information inputs are missing; and so on.

The repository is also used to produce prototypes of the system, showing how the screens will look, what the interface will be like, and which reports the system will produce. The prototypes can be very close in appearance and action to the actual system, yet they are created without using actual program code. This CASE sleight of hand lets users have input into the system before changes necessitate rewriting whole chunks of the program. Thus, users get systems more to their liking.

THE COSTS OF CASE

The CASE tools reviewed here vary considerably in how thoroughly they carry out these functions. Some can start with a meta-level corporate plan, showing what a company does and what its information needs are, and go right through to prototyping individual systems—or, in the case of *MicroSTEP*, even beyond that to code generation. Others concentrate on one or two phases of the process. In some tools, the integration between analysis and design is loose; in other programs, some useful diagramming techniques are missing. When evaluating a CASE tool, it's important to match your needs to the product's functionality.

Functionality, ease-of-use, and completeness are generally reflected in the cost of a CASE tool. The least expensive package reviewed here is *POSE*, which sells in modules for \$595 each. The most expensive is *ProKit*Workbench* at \$9,200. Some products cost up to \$50,000 because they include consulting, installation, and training; this is common with the products offered by a couple of the Big Eight accounting firms. Some tools, such as *POSE* and *vsDesigner*, are modular, allowing you some control over the functionality and price.

Training and support are very important for CASE tools. Trying to learn a CASE tool just by going through the manual is

like trying to learn how to use power tools to build furniture by reading the operating instructions: you'll either cut off your arm or stop using the tools before you've made anything substantial. Some CASE manufacturers offer direct training; others use third parties.

The costs for training can vary from around \$200 per user up to thousands if the company also sets up the tools for you and establishes procedures and policies for their use. Training may also ease the culture shock of moving to a CASE environment. Systems analysts may resist changes because they find it hard to learn a new style of software development, and they may see CASE as the first move toward job obsolescence. Without the proper training and the right sociological approach to implementing CASE, departments may experience subtle forms of sabotage.

BETTER PROGRAMS, LESS MAINTENANCE

The benefits of using a design and analysis tool are considerable, but they're mostly intangible. The most obvious benefit is better-designed software that will require less maintenance later. Engineers point to this as the biggest source of productivity gains with CASE. Programs are better because they are designed more tightly, with little or no overlap in functions; they have no errors and are consistent throughout. Another reason for improved programs is that end users and engineers can test alternatives, playing what-if games with the system design. Since diagrams can be almost instantly redrawn, this kind of testing is painless and will often result in a more creative program.

One measurable benefit is lower personnel requirements. Large projects often force IS departments to add systems professionals; CASE tools may eliminate the need for additional personnel.

Today's design and analysis tools are the second generation of CASE products, and they've already changed considerably.

OUR CONTRIBUTORS

Louis Colella, James Frascella, David Oppenheim, and Daniel Sklar are consultants in KPMG's Peat Marwick National Technology Center in Montvale, New Jersey.

Stuart R. Greenberg is a senior programmer at PC Labs.

Tony Rizzo is senior technical editor of *PC Magazine*.

Andrew Topper is president of Foresite Systems in Okemos, Michigan, which specializes in CASE tool selection, implementation, and structured methodologies. ■



THE MANY STEPS OF SOFTWARE DESIGN

by Andrew Topper

Creating software involves many steps that either occur in sequence or else overlap, and there are parts of each of these steps that are used in subsequent phases. From the original idea of what the system will do through the actual implementation of the finished product, the stages of software development involve many different activities and require different tools and techniques. Most organizations that develop software use a Software Development Life Cycle (SDLC) to describe the order of activities that are

required in the creation of complex programs. CASE software helps them through the steps.

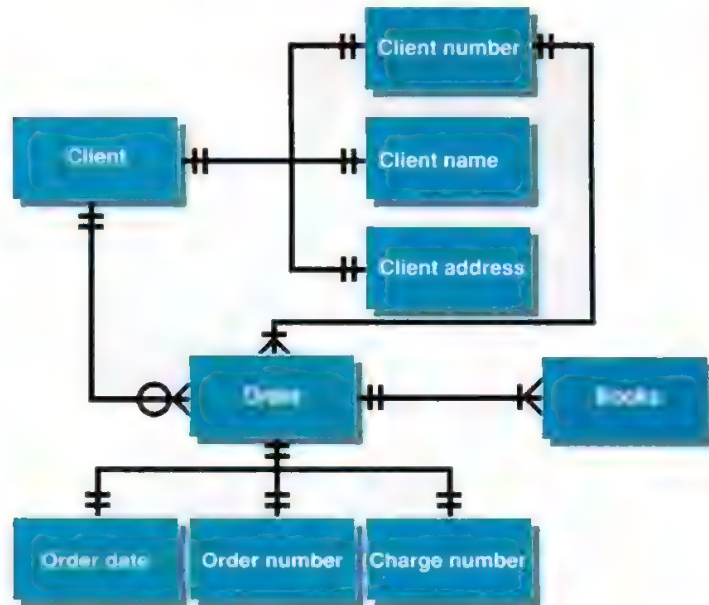
While different SDLCs exist and are used in different organizations, the "waterfall," or sequential, SDLC has become most popular and is the most widely used development process around. This process typically consists of five phases that follow in a sequential fashion.

PLANNING

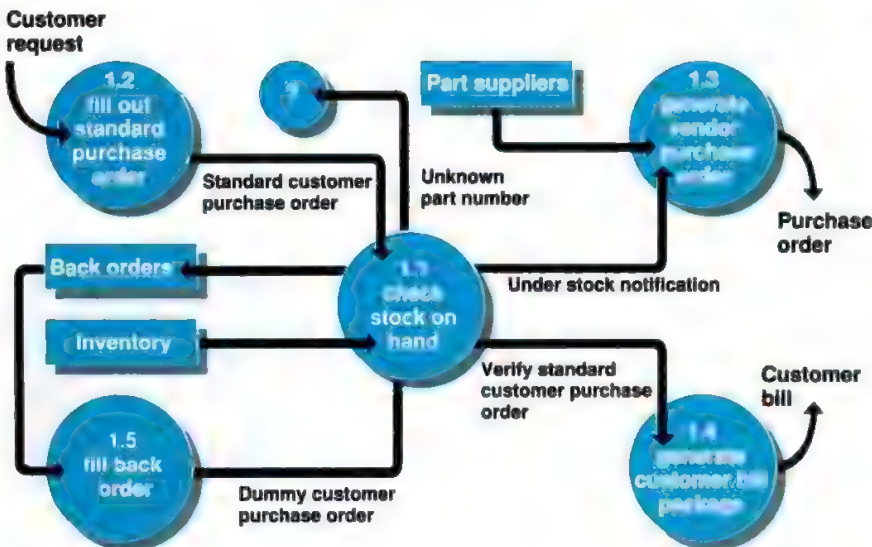
The planning phase deals with allocating resources to projects, scheduling these resources, monitoring and controlling the ongoing activities, and reporting to management on the progress of the project. This phase is sometimes referred to as project management or project scheduling.

Common planning tools include project management diagrams (Gantt charts, Pert charts, and so forth), as well as high-level business modeling tools (entity-relationship diagrams). These tools are used to schedule resources, determine the critical path for the project, and complete high-level modeling.

ENTITY-RELATIONSHIP DIAGRAM



DATA-FLOW DIAGRAM



SYSTEMS ANALYSIS

The second phase of the SDLC is the systems analysis phase: those activities that define, in detail, what the resulting system will do. This is sometimes referred to as defining the functional requirements for the system. Activities that often occur in this phase include interviewing end users, reviewing existing documentation, defining data elements, developing prototypes, and modeling the data and processes that define the functionality of the system.

Tools such as data models (entity-relationship diagrams), process models (data-flow diagrams), and prototypes (screens and reports) are typically created and used in this phase, along with other information collected and stored in the data dictionary or repository for later use. Together, these tools help to create a picture of what functions the system will carry out.

SYSTEMS DESIGN

The third phase of the SDLC is the systems design phase, which is concerned with how the functional requirements (stated in the systems analysis phase) will be supported on the target machine. This phase usually takes the logical models created in the analysis phase and creates the physical design used by the database and programs to accomplish the system objectives. Activities that occur in this phase include physical database design, transaction mapping against the logical data model, module architecture design, and module/subroutine logic definition.

Tools used include database design diagrams and languages (Bachman diagrams), program/system architecture diagrams (structure charts), and program/module logic diagrams or languages (pseudocode, Warnier-Orr diagrams, and action diagrams). These tools define the physical actions that will occur in the system down to the lowest levels, as well as the physical database structures that will support these actions.

PROGRAMMING

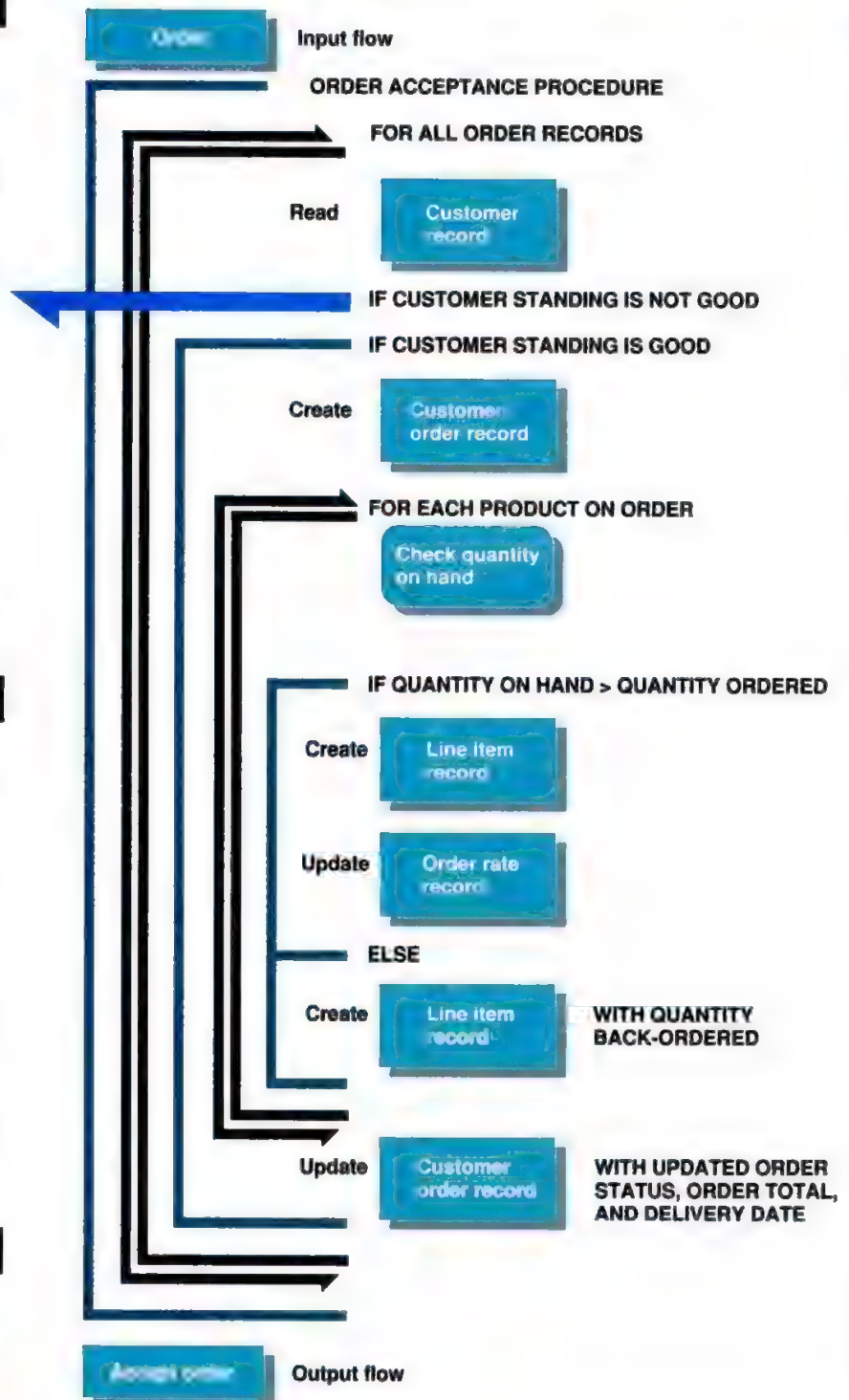
The programming phase takes the database and program specifications created in the systems design phase and translates them into the commands needed to run the system on the target machine. The database specifications are usually converted to DBMS-specific DDL (Data Definition Language) commands or schemes, while the program specs are converted to third- or fourth-generation language statements (COBOL, C, and the like).

These commands are then compiled; they create the executable portion of the system that will be implemented. If testing is part of this phase, tests determine how closely the resulting programs and files meet the objectives of the system as identified in the systems analysis phase.

MAINTENANCE

The maintenance phase is concerned with supporting the system throughout its useful life. Once the system is placed into a production state, it must be kept running and upgraded as required. Typical maintenance tasks include enhancements, bug fixes, and impact analysis on proposed changes to the system.

ACTION DIAGRAM



The diagramming and prototyping capabilities are better, the programs are easier to use, the integration between phases is tighter, and administrative functions have been cleaned up. The programs will continue to improve in these directions, but more-fundamental changes are coming.

Perhaps the most dramatic change will be the use of expert systems in CASE tools. Someday soon, CASE tools will be smart enough to recognize patterns and suggest alternatives for parts of the system. Mistakes in consistency and other types of errors will automatically be fixed. Other changes will bring more flexibility and fuller life-cycle functionality. More programs will cover the whole development process, even the maintenance phase. And CASE tools will become more team-oriented, allowing the repository to be shared over networks. As manufacturers start to incorporate these changes, CASE will expand beyond experimental enclaves. In time, CASE tools will almost certainly become the mainstay of IS departments and the soul of software development.

Henry Fersko-Weiss is a frequent contributor to PC Magazine.

Analyst/Designer Toolkit

by Stuart R. Greenberg

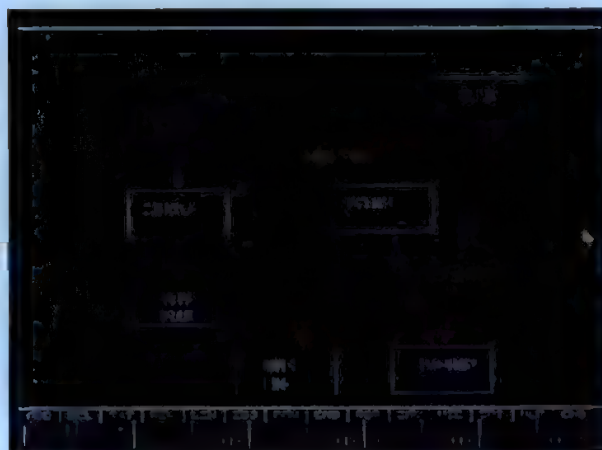
When you think of the pioneers of structured analysis and design, a handful of names come to mind. One such name is Edward Yourdon, whose Yourdon Press has produced many of the design bibles in use today. With graph paper quickly losing ground to monitors, it seems only natural that these pioneers should apply their techniques to PC-based products. Yourdon Inc.'s entry into the highly competitive CASE market is *Analyst/Designer Toolkit*, which is a component of its *Software Engineering Workbench*.

At the heart of the \$2,350 *Workbench* is the *Workbench Core* program containing the menuing and drawing support for the other *Workbench* products. Although other products use this program as their nucleus, the *Workbench Core* provides tutorial and conventional flowcharting capabilities on its own. Installation of the *Workbench Core* must take place before any related product can be installed.

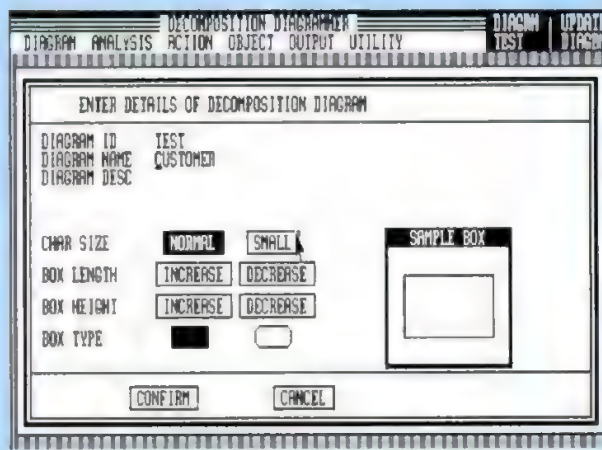
After installing the *Workbench Core*

BOXES AND ARROWS: TAKING A LOOK AT CASE IN ACTION

Because the various data flow, entity-relationship, and action diagrams generated by CASE programs can be very large, the ability of a program to move around those diagrams quickly is important, as is the ability to expose second-level "child" diagrams hidden beneath larger schemes. Note that although industry-wide standards for the signs and symbols of CASE diagramming exist, every CASE package takes some liberties in its charting designs.

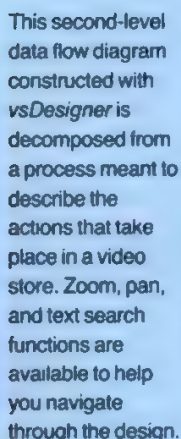
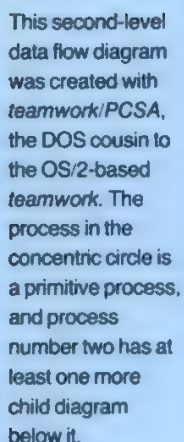
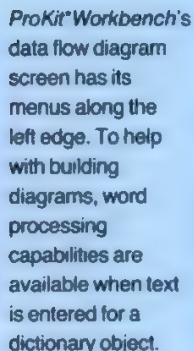


Here's an example of a logical data structure screen from *Auto-Mate Plus*. Large models can be constructed with the package; data flow diagrams can have 250 symbols, 200 expanded processes, and nine levels of explosion.



This decomposition diagram setup screen from *POSE* is located in the *Process Model Toolkit*, along with setups for data flow, structure chart, and action chart diagrams. The graphics aren't pretty, but *POSE* is one of the least expensive CASE tools available.

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and two related products, *Analyst/Designer Toolkit* and *Compose*, you may want to try the tutorials. The *Workbench Core* tutorial takes you to the main editing screen, which contains a large drawing area bounded by a message area, a navigation port (which indicates the portion of the whole chart currently in the drawing area, an icon menu, and the command menu. The screen colors effectively set the different sections of the screen apart from each other, making your work easy to see.

The icon menu to the right of the drawing area contains two columns of ten icons each plus a set of scroll buttons for each column. You can set the amount of scrolling, but there is no indication when the end of the list is reached. It takes a keen eye to notice when the icons start repeating. Some of the icons contain text that's illegible even in EGA mode.

A Clear button used to back out of previous actions and a Help button are at the lower left. A two-line menu runs along the bottom of the screen. The upper line contains major functions; the bottom line changes to show commands related to the function currently selected.

Command names are limited to four characters, causing some to be drastically abbreviated, such as USSC for Unassociate and RERT for Reroute. The abbreviations are jarring, but obviously it becomes less of a problem as you gain some experience with the program.

The tutorial uses icons representing items in a zoo as a generic example of developing diagrams. The instructions are easy to follow except for numerous typo-



A black 3.5-inch floppy disk is shown at an angle. The label on the disk is black with white text. At the top, it says "YOUR DON". Below that, there is a small rectangular area with some illegible text. At the bottom right of the label, there is a small square logo containing the letters "PDC".

List Price: \$2,350
Requires: 64K RAM, graphics adapter, mouse, 10MB available disk space, DOS 2.0 or later. Copy protected
In Short: A diagramming tool based on the Yourdon principles of structured design. Limited screen and output resolution as well as types in the documentation leave this product a step behind current PC technology. Expect a new release in September to address these shortcomings.

ORDER NOW FOR FRIENDLY SERVICE CARD

SOFTWARE

CASE

graphical errors that could be a major frustration to someone with a mainframe background who is unfamiliar with the operation of software on a PC. According to a spokesperson, a total rewrite of the documentation was expected with a new release due to ship too late for evaluation.

A problem arose during the lesson on finding diagramming errors. The diagram I was instructed to load contained no errors, even though the tutorial said it should. I later discovered that the *Compose* program had installed a corrected copy of the same file in place of the one with the errors.

Errors in the documentation aside, the *Workbench Core* program proves easy to work with. You'll quickly learn several shortcuts. For example, multiple icons or connectors may be placed by selecting sev-

eral locations and clicking on the desired icon or connector once. Icons and connectors can also be manipulated as a group, making even drastic changes fairly simple.

FLAGS DIAGRAMMING ERRORS

Some diagramming errors such as improperly connected icons are immediately flagged by an error icon at the error location and a message at the top of the screen. More subtle errors are marked in the same manner when the File Verify command is executed. Selecting any error icon and clicking on Help produces a description of the particular error. These descriptions are sometimes a bit cryptic, but not impossible to figure out.

To the basic flowcharting capability of

Workbench Core, *Analyst/Designer Toolkit* adds the ability to plot such diagram types as data flow, entity relationship, and state transition, as well as context diagrams and structure charts. These diagrams are constructed using the same techniques of the *Workbench Core*. The *Analyst/Designer Toolkit* manual contains tutorials for each type of chart.

The *Analyst/Designer Toolkit* also includes a project dictionary. One or more diagrams may be imported into a dictionary file and, once imported, any change to the diagram will automatically appear in the dictionary.

Several reports are available from the dictionary, including a project verify report that verifies the entire project's integrity through all levels of diagrams.

An IADF (Interactive Access Data Fa-



CASE SOFTWARE: SUMMARY OF FEATURES

(Products listed in ascending price order)

	POSE	Visible Analyst Workbench	vsDesigner	Analyst/Designer Toolkit	teamwork	Auto-Mate Plus	DesignAid
List price	\$595 per module; four modules, \$1,195	\$595 per module	With vsSQL, \$1,950; with vsAuthoring, \$9,950	\$2,350	\$4,995	\$6,900	\$6,900: RT and DM modules, \$1,500 each

DIAGRAMS SUPPORTED

Data modeling

Entity relationship	☐	☐	☒	☒	☒	☒	☒
Data model	☒	☐	☒	☐	☐	☒	☒
Logical database	☒	☐	☒	☐	☐	☒	☒

Process modeling

Data flow	☒	☒	☒	☒	☒	☒	☒
Decomposition	☒	☐	☒	☐	☒	☐	☒
Process specs or mini specs	☒	☐	☒	☒	☒	☒	☒
Process dependency	☐	☐	☐	☐	☒	☒	☒
Process action	☒	☐	☒	☐	☒	☐	☒

Data design

Physical database	☒	☐	☐	☐	☐	☒	☒
Data structure	☐	☐	☐	☐	☐	☒	☒

Procedure design

Structure charts	☒	☐	☒	☒	☒	☒	☒
Decomposition	☒	☐	☒	☐	☒	☒	☒
Jackson structure	☐	☐	☒	☐	☐	☐	☒
Warnier-Orr charts	☐	☐	☒	☐	☐	☐	☒
Nassi-Schneiderman charts	☐	☐	☐	☐	☐	☐	☒
Hierarchical input-process-output	☐	☐	☐	☐	☐	☐	☒
Flow charts	☐	☒	☐	☒	☒	☒	☒
Action charts	☒	☐	☒	☐	☐	☐	☒
Decision tables or trees	☐	☐	☐	☐	☒	☐	☒
Module specs or mini specs	☒	☐	☒	☐	☒	☒	☒
State transition	☐	☐	☒	☒	☒	☐	☒

☒—Editor's Choice ☒—Yes ☐—No

cility) button provides a shortcut to the project dictionary while in the diagram editor.

The final component installed, *Compose* uses commands embedded in text files to tie text and charts into a printed document.

Some enhancements to this product are definitely needed. At this time there is no support for any graphics mode above standard EGA, no use of expanded or extended memory, and no mouse support in the project dictionary.

Hard-copy output limited to Hewlett-Packard plotters and Epson printers isn't really adequate. Although a plotter emulator will output to an HP LaserJet, the output looked very coarse. The ability to generate output in various standard graphics formats, (such as TIFF, .PCX, PostScript, and others,) is a must for document pro-

duction these days. Some of these enhancements are promised for the next release of the product.

Although CASE tools are still in their infancy, Yourdon's *Software Engineering Workbench* has a lot of growing up to do to meet the needs of today's designers.

Auto-Mate Plus

by Louis Colella and James Frascella

If you're looking for a front-end CASE product with a very solid methodological base, take a look at *Auto-Mate Plus*, the \$6,900 offering from LBMS. *Auto-Mate Plus* is more than just a product with its roots in England, it's an analysis and design product with strong logical database design support for commercial MIS applications. Although it doesn't assume any prior understanding of its underlying methodology, there are two binders of reference information, including a tutorial that offers assistance if you are unfamiliar with the proprietary methodology of LBMS (LSDM) or the methodology of the British government (SSADM).

As with most other CASE products, you can derive the greatest benefit from *Auto-Mate Plus* if you already have a good grasp of structured methodology and techniques. In fact, it may make the most sense to use this product in an environment where either LSDM or SSADM is the methodology of choice. While *Auto-Mate Plus* can offer graphical support for other structured methodologies and techniques, it does not have rule-checking for those methodologies as it does for LSDM and SSADM.

Auto-Mate Plus addresses the early stages of the system development life cycle: specifically, requirements definition, analysis, and logical design. There is an optional Database Generator module (DBG) available that can convert the logical database design to a physical one; that module was not part of our evaluation software. One thing is certain: *Auto-Mate Plus* has depth; there is a lot to know and understand about this product.

INSTALLATION

Installation is fairly straightforward, and the software requires 12.5MB of hard disk storage space. Installation instructions are

easy to follow, and the vendor supplies responsive technical support when questions arise. Configuring the environment for the product isn't difficult, especially since the install procedure automatically modifies your AUTOEXEC.BAT and CONFIG.SYS files so that DOS can run the software.

Auto-Mate Plus is delivered with three volumes of documentation in two binders. Although the documentation seems thorough, it can be difficult at times to find the specific information you need. It might make sense for LBMS to supply three binders for their three volumes and reorganize the material so that the user guide and reference manual are clearer. Further, the documentation would be much easier to use if each volume had an enhanced index and a glossary of terms. The product's ex-



FACT FILE

Auto-Mate Plus,
Version 3.02
Learmonth & Burchett
Management Systems
Inc., 2900 N. Loop W.,
#800, Houston, TX
77092, (800) 231-7515,
(713) 682-8530
List Price: \$6,900;
\$1,725 for DB Generator.
Requires: 640K RAM, graphics adapter, 12.5MB
available disk space, DOS 2.1 or later. Copy
protected
In Short: A menu-driven package with strong
logical-database-design support for commercial
MIS applications. Underlying the product is a
structured development philosophy called
LSDM AM (LBMS Structured Development
Method Auto-Mate). Supports other
methodologies but doesn't provide rule checking
for them.



CIRCLE 606 ON READER SERVICE CARD

tensive reliance upon terminology appropriate to LSDM or SSADM may facilitate mastery for users with that orientation, but it will really stretch the learning curve for those without such familiarity.

EASY, YET COMPLEX

Auto-Mate Plus is menu-driven, and navigation through the menu hierarchy is fairly easy because in addition to the menu structure, there is a nice jump feature that allows you to traverse the hierarchy without the bother of backing out through layers. In only a few days, you can become familiar with the product's features at a high level, but mastery will require more time.

Users who are familiar with the ease and convenience of the Macintosh (point,

Excelsior	IEW/Analysis Workstation; IEW/Design Workstation	ProKit* Workbench
\$8,400	\$8,625 each	\$9,200

■	■	■
■	□	□
□	■	□
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CONTINUES

SOFTWARE

CASE

click, and drag), however, may find this product's graphical interface a bit cumbersome. Almost any picture-editing activity requires a two-step process. First, the desired action (add, change, link, and so forth) must be selected from a menu across the bottom of the screen, and then the particular icon to be affected must be specified. This is tiresome when you're working with diagrams of any complexity.

Another interface idiosyncrasy of *Auto-Mate Plus*, arising perhaps from its British pedigree, is its reversed use of mouse buttons. Anyone accustomed to driving with the left button will find themselves bounced out to DOS, since left is escape with this product. It would be nice if you could specify mouse button preference instead of being forced to adapt to right button use. Aside from this annoyance, the product presents a clear screen layout and useful color scheme that make for efficient work.

CODE VALIDATION

Auto-Mate Plus checks diagrams when they are loaded into its design database. For instance, it can check syntax (adherence to naming standards, to give one example) as well as check the consistency of the logical database design. It does this, however, only with respect to the LSDM and SSADM methodologies and only within a single diagram type.

The product will allow you to establish cross-references between diagram types manually (by linking the LDS entity and data-flow diagram data-store names), but there is no real checking of consistency across diagram types. If you delete a cross-referenced item from one diagram type, the item will be removed from the cross-reference report but will remain in the other diagram. Since the validation process doesn't take place until you load the dia-

gram, you must go back and forth between the load facility and the picture editor when making corrections. It would be nice if there were some direct validation during the picture editor session.

Auto-Mate Plus facilitates creation of diagrams and reports that are useful during

Auto-Mate Plus checks diagrams when they are loaded into its design database.

the analysis and design stages. The diagram types it offers include data flow, data structure, entity, dialog, database, and



CASE SOFTWARE: SUMMARY OF FEATURES

(Products listed in ascending price order)

	POSE	Visible Analyst Workbench	vsDesigner	Analyst/Designer Toolkit	teamwork	Auto-Mate Plus	DesignAid
PROTOTYPING							
Screen painting/layout	■	■	□	□	□	□	■
Screen editing criteria	■	■	□	□	□	□	■
Screen data-entry and storage	■	■	□	□	□	□	■
Screen data reporting	■	□	□	□	□	□	■
Screen flow control	■	■	□	□	□	■	■
Report painting/layout	■	□	□	□	□	□	■
REPOSITORY							
Security controls	□	■	■	□	□	■	■
Access privileges	□	■	□	□	■	□	■
Multuser access	□	■	■	□	□	□	■
Version control	□	□	□	□	■	□	■
VERIFICATION CAPABILITIES							
Rule-based	■	□	■	■	□	■	■
Reports	■	■	■	□	■	□	□
Completeness/consistency checking	■	□	■	■	■	■	■
Functional decomposition checking	■	■	■	■	■	■	■
Cross-diagram checking	□	□	□	□	□	■	■
PERIPHERALS SUPPORTED							
PostScript printers	■	□	□	□	■	□	■
HPCL printers	■	■	■	□	■	■	■
HPGL plotters	■	■	□	■	□	■	■
SUPPORT							
Telephone support	■	■	■	■	■	■	■
Training from vendor	■	□	□	■	■	■	■
Trial evaluation period (cost, applicable toward purchase)	30 days (full price with money-back guarantee)	30 days (\$200)	60 days (\$495)	2 weeks (free)	60 days (\$500)	30 days (free)	None

■—Editor's Choice ■—Yes □—No

others specific to the LSDM methodology. Support for database design through schema generation is strong via a normalization facility that interactively questions you in order to help bring a model to third normal form. However, within the data-flow diagrams you are limited to 60 characters for describing a process, and although there are diagrams to design navigation through the system, prototyping facilities are limited (no screen or report layouts).

Whether the deliverables from the analysis phase are sufficient for someone working on design or programming will depend to a great extent on the experience level of that individual. There seems to be room for a tighter fit between the design and the development stages.

Given the time constraints of the review process, we did not create models to test the full limits of capability stated in the documentation (namely, 250 symbols per picture, 200 expanded processes per data-

flow diagram, 9 levels of explosion per data-flow diagram, and others). Our testing did suggest that *Auto-Mate Plus* could accommodate large application systems reasonably well.

The program's limited workgroup support is a drawback. The single-user version can be installed on a LAN file server, but there is no shared access of files or record locking at this time.

A list of suggested improvements would include the following: immediate checking of the rules during the picture-editing session, checking of consistency across diagrams types, multiuser access to the design database, prototyping facilities, a simplified graphical interface, and windowing for concurrent access of such features as the picture editor and the data dictionary. We believe these features belong in a state-of-the-art front-end CASE product, and LBMS indicated that the next release of *Auto-Mate Plus* will incorporate many of them. We look forward to that release and to seeing an already good product become even better.

DesignAid

by Tony Rizzo

Nastec Corp.'s \$6,900 *DesignAid*, Version 4.3, is a very successful CASE implementation. It is a complex tool to be sure, but only in the sense that software design is complex. *DesignAid* is quite well designed, and given what it has to do, it's very easy to use.

The basic *DesignAid* model consists of creating a project directory, building a project dictionary (done from outside the *DesignAid* system itself through a supplied utility), and logging on to the system. Once in the system, the design stage can go in any one of several ways. Structures can be defined, diagrams created and linked to various diagram levels, and so on. The possibilities are many.

You'll immediately become aware of the central paradigm of the *DesignAid* system: nested files. Files that are logically linked together can be opened inside of each other (nested) and visually depicted on the screen. For example, it is possible to have a diagram with various processes, each of which may be associated with various other diagrams or files. A file might be a simple process or a data store description

(a narrative); another file might be a diagram of a detailed control/data flow for a given process, one that shows child/parent relationships in detail.

QUICK, EASY, LOGICAL

There is a logical reason for nested files. They let you move from one level to another by simply crossing "file boundaries." Or, you can simply remove a file to move back up one level. The important point is that *DesignAid* has successfully managed to implement a means of moving quickly, easily, and logically from one level to the next within a given project.

DesignAid also allows you to define "files" within your files or diagrams by enclosing filenames in brackets. Whenever *DesignAid* sees a bracketed word, it understands that this word is a reference to a file. This enables you to read a file by simply moving the cursor to the file and asking the system to read the file, which it will then logically nest for you. You can read a narrative file associated with, say, a particular object in a diagram, via a very quick two-keystroke sequence.

A benefit of bracketed files is that summary files (or menu files) can be created that list project files within brackets while providing descriptions of what each file does. A file can be quickly opened and examined simply by moving to it and calling it up. Menu files can also serve as an easy means of grouping files so that operations common to all of them can be applied to just the one menu file.



FACT FILE

DesignAid, Version 4.3
Nastec Corp., 24681
Northwestern Hwy.
Southfield, MI 48075;
(800) 872-8296, (313)
353-3300
List Price: \$6,900;
\$1,500 for RT (real-time)
module; \$1,500 for DM
(data-modeling) module
Requires: 640K RAM, graphics adapter, 20MB
available hard disk, mouse, DOS 2.1 or later
Copy protected
In Short: A high-end CASE tool that supports a
wide range of capabilities, it offers a unique user
interface, diagramming tools that include a very
powerful autodraw function, and extensive data-
dictionary features. *DesignAid* is specifically
designed for use in large-scale, sophisticated,
and very complex projects and boasts the tools
necessary (including substantial training and
company support) for successful use in such an
environment. A top-notch product in all respects.

CIRCLE 606 ON READER SERVICE CARD

ENDS

The word processing component of *DesignAid*, modest but reasonably complete, contains standard features such as right justification, centering, margin and tab control, and others. These features can be called either from within a diagram or from within a narrative file. For example, if you create a process box and insert some text into it, you can quickly and easily center or justify the text.

STRAIGHTFORWARD INPUT

Drawing diagrams is quite simple and straightforward. There are no mysteries or difficulties to get around, though there should be a better mouse interface. *DesignAid* contains a substantial collection of graphics elements that allow the user to place all sorts of predefined images in a diagram. Objects are easy to move around and resize.

The latest enhancement to *DesignAid*, included in the Version 4.3 release of the software, is a very powerful feature called Autodraw. As the name suggests, this component allows a means of automating the diagramming process to a certain extent.

For the most part diagramming is completely menu-driven, though there are keyboard-equivalent shortcuts to every menu item. The user selects the type of diagram, the necessary component (process, data store, or some other one), the means by which components are connected, and so on. Cursor movement is accomplished either by a mouse or by the cursor-movement keys.

Of course, none of *DesignAid's* successful user interface design would be worth even a penny if the data dictionary, validation tools, and supported methodologies were weak. Well, they aren't; in fact, they are quite powerful. Even a quick perusal of the features table shows *DesignAid's* features list to be as extensive as can possibly be expected. Also supported, albeit as options to the standard *DesignAid* package, are real-time analysis and data modeling, which were not evaluated.

DesignAid is copy protected by means of a key block that attaches to either LPT1 or LPT2. It is unobtrusive and in no way affects the ability to print. At \$7,000 to \$9,000 in its various configurations, it's hard to complain about copy protection. Is any software worth that much money? In the limited, real-world software design arena that *DesignAid* competes in, it certainly is—if it can do the job. *DesignAid* does it with flying colors.

Excelerator

by Andrew Topper

Index Technology's \$8,400 *Excelerator* is probably the most recognizable and among the most attractive CASE products currently on the market. It owes much of its success in the front-end CASE tool marketplace to being one of the original CASE products available for the IBM PC. Being first, however, does not guarantee long-term success; there are many other reasons why *Excelerator* has been the CASE tool of choice for the majority of companies that have implemented a CASE tool.

Excelerator is a mature product that delivers quality tools to help support the systems analysis and design phases of the software development life cycle (SDLC). Its many virtues include solid analysis and design diagramming tools, extensive verification checking against structured meth-

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odology rules, complete screen and report prototyping, and excellent presentation graphics and documentation-generating capabilities.

In addition, since *Excelerator* has been the most successful product on the market, many of the other CASE vendors have developed interfaces to it to or from their product line. Since many companies are planning to eventually support CASE tools

for the entire SDLC, these interfaces represent a significant strength that *Excelerator* has over other PC-based front-end tools.

Accessing the *Excelerator* system is done by means of a sign-on screen where the user ID and password are entered. A project is then selected from the user's predefined individual list. The main menu offers access to the components of the product including graphics, screen and reports, analysis, housekeeping (set or change the system profile, assign users to projects, and so on), XLDictionary, documentation, and the XLD Interface. The *Excelerator* interface uses the equipment, keyboard, mouse, and screen display in a consistent and efficient manner. While the product delivers a wealth of options and capabilities, the *Excelerator* menus and screens are easily accessible and share a common format.

At the heart of the product is the XLDictionary (or XLD), the repository containing all objects used by *Excelerator*. Within the XLD, many different projects can be set up and users (development team members) can be given access to these projects by the project manager. The system manager creates user IDs and assigns passwords for the product. *Excelerator* is capable of sophisticated reporting, including standard and ad-hoc reports run against the entities contained in the XLD.

The XLD interface allows access to dictionary utility functions such as backup, restore, project locking and unlocking, exporting and importing. A new addition to the *Excelerator* product line is the XL/Quickstart tool, which contains an on-line standards and procedures manual for the entire SDLC. XL/Quickstart offers developers a wealth of information that can be viewed on-line, such as object-naming conventions and guidelines for maintaining diagrams and prototypes, as well as guidelines for generating presentation materials and documentation.

DOCUMENTATION GENERATION

The documentation-generating capabilities in *Excelerator* offer a seemingly endless range of options and report formats. *Excelerator* is also one of the few products (if not the only) that offers extensive support for creating, maintaining, and printing documentation or presentation materials. The Document Graph and Presentation Graph types in *Excelerator* allow the developer to lay out and print reports, entity descriptions, prototypes, and diagrams



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CIRCLE 124 ON READER SERVICE CARD

and will automatically generate the finished document.

Also new to *Excelsator* is support for requirements traceability. Release 1.9 of *Excelsator* allows for the creation of User Requirements and Engineering Requirements, both of which can be attached to other objects such as screens or reports and diagrams and reported on at a later date. In this fashion, the requirements of a system can be tracked throughout the project's life to ensure that the deliverables for the system are being produced and that requirements are being met.

Finally, the vendor support for the product, including training and documentation, is complete and thorough, and the tutorial serves as an excellent example of how *Excelsator* can be used to support the software development process.

While *Excelsator* has many strengths, it is not without some minor weaknesses. The product does not currently support shared access to objects or diagrams in a LAN environment, as do some of the other front-end CASE tools. While the current release offers LAN support for Novell, IBM, 3Com, AT&T, and Banyan LANs, manual procedures must be used to extract objects from the XLD and populate desktop dictionaries when more than one person is working on a project. Companies looking for a tool that supports true, multiuser access to the objects in the repository will have to address these access issues manually if they choose *Excelsator*.

Another drawback to *Excelsator* is that it uses a proprietary user interface and currently does not support viewing or updating of multiple objects on a single screen. For example, a diagram cannot be displayed on the screen alongside informa-

tion from the dictionary or from prototypes. Release 1.9 has an interactive browse capability for objects in the XLD, which helps in this area, but a true, windowed interface is definitely helpful with CASE tools. Index Technology has stated

Perhaps the most significant aspect of *Excelsator* are the third-party products with which it can be linked.

that Version 2.0 of *Excelsator*, which is scheduled for availability in the second quarter of 1990, will support the OS/2 Presentation Manager interface and will address this issue more directly.

Also missing from *Excelsator* are true version-control capabilities that allow the developer to save or freeze the contents of a project and then recover or roll back to that version at a later date. While the current version of *Excelsator* has a lock and unlock capability that could be used as a rudimentary version- or change-control feature, this facility is limited to locking single occurrences of objects in the XLDictionary to prohibit concurrent updates.

The current version of *Excelsator* also supports database design information that can be used to show physical DBMS details, but this capability is limited to physical length, access type, and access frequency. Although *Excelsator* furnishes a link to IBM's DB2 mainframe database that allows generating DDL commands and exporting objects to the IBM Data Dictionary, adding more database design information to the XLD would make sophisticated database design easier and even more effective.

THIRD-PARTY COLLEAGUES

Perhaps the most significant aspect of the *Excelsator* product line are the third-party products with which it can be linked. These include a variety of programming

environments, databases, and project managers that offer a means of integrating *Excelsator* with other front-end and back-end CASE tools, as well as with mainstream applications.

In addition, IBM has recently purchased a 5 percent share in Index Technology and will be working with Index on creating *IBM Repository Manager*, due out in June of 1990. This IBM product, which initially will be mainframe-based, will attempt to establish a common format for exchanging CASE information between tools. IBM's decision to invest in Index Technology should further enhance the latter's image and help make *Excelsator* even more popular.

The continued success of *Excelsator* will depend on how the minor weaknesses of the product are addressed in upcoming versions and on Index Technology's continuing commitment to overall quality. The strength of the latter indicates that the *Excelsator* product line should continue to evolve and address the issues of software development into the 1990s as CASE becomes more prevalent on the PC.

IEW/Analysis Workstation IEW/Design Workstation

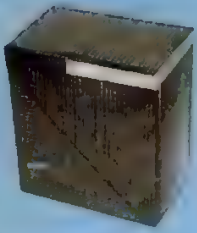
by Andrew Topper

Another product that has enjoyed much success in the high-end CASE market is the *Information Engineering Workbench* (IEW) from KnowledgeWare Inc. This group of products includes PC-based workstations for planning, analysis, design, and construction (or programming). KnowledgeWare also produces a mainframe code-generating product, *GAMMA*, with a central repository that can be populated from the front-end tools located on the PC. Together, these products support all phases of the SDLC except maintenance.

We evaluated Release 5.0 of both the *IEW/Analysis Workstation* and the *IEW/Design Workstation* (\$8,625 each). KnowledgeWare has made excellent use of Digital Research's *GEM* interface in the *Workstation* products, and the result is a very user-friendly, consistent screen and keyboard/mouse interface. When you use the *IEW Workstations*, you are initially



FACT FILE



Excelsator, Version 1.9
Index Technology, One Main St., Cambridge, MA 02142; (617) 494-8200.
List Price: \$8,400.
Requires: 640K RAM, graphics adapter, mouse, 10MB available disk space, DOS 3.1 or later. Copy protected.

In Short: A full-featured analysis and design CASE tool that supports prototyping, structured diagrams, and a central repository. The leading front-end CASE tool on the market, *Excelsator* delivers the power and flexibility not found in most tools, along with links to most of the major front- and back-end CASE tools.

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• 768

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• 8 MB

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AD CODE 11BA3

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SOFTWARE

CASE

met with a sign-on screen asking for your user ID and password. After having your ID and password verified, you're presented with a workspace that has menu options across the top of the screen in typical *Microsoft Windows* or *Macintosh* style. The use of windows and icons within the *IEW Workstations* helps make using them less of a chore and, in general, more interesting.

DIAGRAM WINDOWS

The strengths of both *Workstations* lie in their analysis and design tools capabilities, among which are good data modeling, process modeling, database design and procedure design diagramming tools. Another big plus for these products is their ability to view and/or update more than one object or diagram at one time on the screen. Each diagram type can have its own window under the *GEM* interface, and multiple windows can be resident si-

FACT FILE

IEW/Analysis Workstation and Design Workstation, Version 5.0
KnowledgeWare, 3340
Peachtree Rd. NE,
#1100, Atlanta, GA
30026, (404) 231-8575.
List Price: \$8,625.

Requires: 640K RAM, 4MB extended memory or 4MB 4.0 LIM expanded memory, graphics adapter, 12MB available disk space, mouse, DOS 3.1 or later.

In Short: These are two of four PC-based modules that support the planning, analysis, design, and construction (programming) phases of the software-development lifecycle. The packages support some aspects of the information engineering and most of the software engineering diagramming tools and techniques in an integrated, windowed environment.

CIRCLE 34 ON READER SERVICE CARD

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other objects

The *IEW* is especially helpful in logical data base design tools. It supports flat, hierarchical, and relational as well as data-structure of these types. The hierarchy supports IBM's IMS/DL1 D. generation, while the relational supports DB2/SQL-format DDL. Since the *IEW/Analysis* and *IEW/Design Workstations* are part of a group of integrated products, they also form a tightly coupled link to the other tools in the product set, namely the planning and construction (or programming) tools.

While the mainframe code-generation product, *GAMMA*, has been available for some time, KnowledgeWare has recently

FROM FLOWCHART TO CODE WITH MicroSTEP

by Andrew Topper

Recently Syscorp International introduced *MicroSTEP*, a PC-based back-end CASE tool that generates Lattice C source code and .EXE files from diagrams and specifications. While there are plenty of other PC-based application generators on the market (including *Pro C* and *DataBoss*), *MicroSTEP* is the first true graphics-based code generator to arrive. The *MicroSTEP* system is capable of generating menus, screens, reports, and batch programs from modified data-flow diagrams, screen and report layouts, data-structure definitions, and activity descriptions.

The "STEP" in *MicroSTEP* stands for Specification To Executable Program and represents *MicroSTEP*'s ability to generate executable programs from specifications or diagrams. *MicroSTEP* is actually composed of two major parts: a specification editor and a data dictionary. The specification editor is used to diagram the flow of activities in the system (by placing icons on the screen) as well as linking entities (data stores, processes, and the like) with arrowed lines. Inputs and outputs are specified simply by drawing a line from the data store to the process. The

data dictionary contains the data structures and screen/report formats for the application.

MOUSE AND KEYBOARD

MicroSTEP uses a proprietary interface that relies on both mouse and keyboard input and is set up in a very intuitive manner. The fact that the screen layouts and menu options are consistent and that each screen has a Return menu option and a quit button (R, E, or Q) in the top-right-hand corner of every screen makes using the product relatively easy. The current *MicroSTEP* interface does not support color, but the applications generated by the product can be set up to use color if the developer chooses. When the product is initially loaded, the main menu offers options for utility functions, specification creation, and dictionary access.

MicroSTEP's major strength is its ability to generate entire applications (C programs and .EXE files) from modified data-flow diagrams. While mainframe code generators have been on the market for several years, *MicroSTEP* is the only PC-based product that attempts to create finished programs from pictures. An additional benefit to the product is its support for *dBASE III Plus*

files and its ability to import database structures directly into the data dictionary.

Once flow diagrams have been created, they are checked for errors. *MicroSTEP* uses a set of rules and limits that determines the order of processing and the actions that occur in a standard screen activity. These rules are applied to the specifications (diagrams), and an error list is produced when the application is generated. When changes are made to individual specifications, only the ones that are affected are regenerated and recompiled. The verification of the diagrams and the program's ability to regenerate only those parts of the application that are changed are evidence of the program's sophistication and versatility.

Another aspect of *MicroSTEP* that benefits the developer is the way fields are mapped from input data structures to output data structures. *MicroSTEP* automatically generates code to move the input fields to their corresponding output fields when the field names are the same. Developers can override these mappings if they need to, and they can also use functions to load derived or calculated fields as required.

EXTERNAL ROUTINES

MicroSTEP also supports external routines that are created by the developer

announced a PC-based version of the *IEW/Construction Workstation* that also supports the generation of COBOL code. While other front-end CASE products may act as a bridge to back-end CASE tools (code generators), the fact that the KnowledgeWare product set uses the same repository (specifically, the Encyclopedia) for design and programming means that the transition of the design specifications to physical program code is more complete and consistent.

NO LAN SUPPORT

While the *IEW* tools have many strengths, they are not without their weaknesses. For example, developers who are planning to use the *IEW Workstations* with the information engineering technique will find that the products do not fully support all of the diagram types used in this structured methodology. The current release of the *IEW/Analysis* and *IEW/Design Worksta-*

tions do not support screen or dialog-design diagrams or data-navigation diagrams, both of which are used in the IE methodology. In addition, although the *IEW* products contain a number of mainframe-oriented database-design tools, these tools will be only marginally effective when generating PC-based database structures.

The current versions of the *IEW/Analysis* and *IEW/Design Workstations* do not offer multiuser support on a LAN, although the contents of their Encyclopedias can be manually uploaded and downloaded to or from the mainframe Encyclopedia. Also missing from the current *IEW* products are sufficient documentation-generating capabilities, version and change controls, and any inherent requirements traceability function. A maintenance update, Release 5.01, shipped too

late for evaluation.

The prototyping in the *IEW/Design Workstation* is almost nonexistent, with no support for reports and only a limited screen-display capability. This product would certainly benefit from a more sophisticated screen prototyping capability that would allow data to be entered and the simulation of screen flow. Buyers who are considering the *IEW* products should also be aware of the hardware requirements for the products. KnowledgeWare recommends at least 4MB of extended or expanded memory when using the *Workstations*.

With the recent introduction of the *IEW/Construction Workstation* and the many strengths of the *IEW/Analysis* and *IEW/Design Workstations*, the *IEW* product set should continue to grow in popularity. The existing weaknesses of the product line can easily be overlooked if buyers are looking for a set of integrated tools that

and called from the flow diagram. This gives developers added flexibility in using their own code in addition to the code generated by *MicroSTEP*.

Anyone who considers buying *MicroSTEP* should check the limits and rules for the product prior to making a purchase decision. While most of the rules should not adversely affect the finished application, some of the rules and limits may require additional processing logic, such as combining several physical inputs into a single logical input structure. This can add some complexity and a little overhead to the generated code.

Also, those organizations planning to use *MicroSTEP* in conjunction with a front-end CASE tool should note that it uses a modified data-flow diagram (DFD) and not the standard one of Yourdon-DeMarco or Gane-Sarson fame. While the modifications made by Syscorp to the flow diagram help in specifying the logic for a program, the fact that *MicroSTEP*'s diagrams are different from standard data-flow diagrams may cause problems when converting from other front-end CASE tools that support the traditional DFD format.

Perhaps the biggest drawback of the current version of *MicroSTEP* is its lack of an active data dictionary. Using the dictionary is optional, and *MicroSTEP* does not currently support storage of all

of the entities in an application including activities and processes. Without an active repository or data dictionary, *MicroSTEP* lacks the cross-reference, access control, change and configuration control capabilities most development

data structure. While adding additional fields to the global data structure may not adversely affect the finished application, requiring maintenance of these fields by all programs that pass control can complicate the code generated.

MicroSTEP also requires a significant amount of memory to run and there is currently no support for expanded or extended memory. Anyone planning to use *MicroSTEP* had better be sure they have at least 575K RAM available after DOS is loaded so that the program can execute.

While *MicroSTEP* does deliver on the promise of generating complete, finished applications in a PC environment, the resulting capability does have its price. Since *MicroSTEP* lists for \$5,000, it may be out of the reach of smaller development shops. Also, since there is currently no LAN support for the product, group development teams will have to work around the shared application environment manually. But *MicroSTEP* is the first true PC-based code generator that works from structured diagrams and, with its list of impressive capabilities, it is definitely worth looking at.

MicroSTEP, Syscorp International, 9420 Research Blvd., #200, Austin, TX 78759; (512) 338-0591. **List Price:** \$5,000.

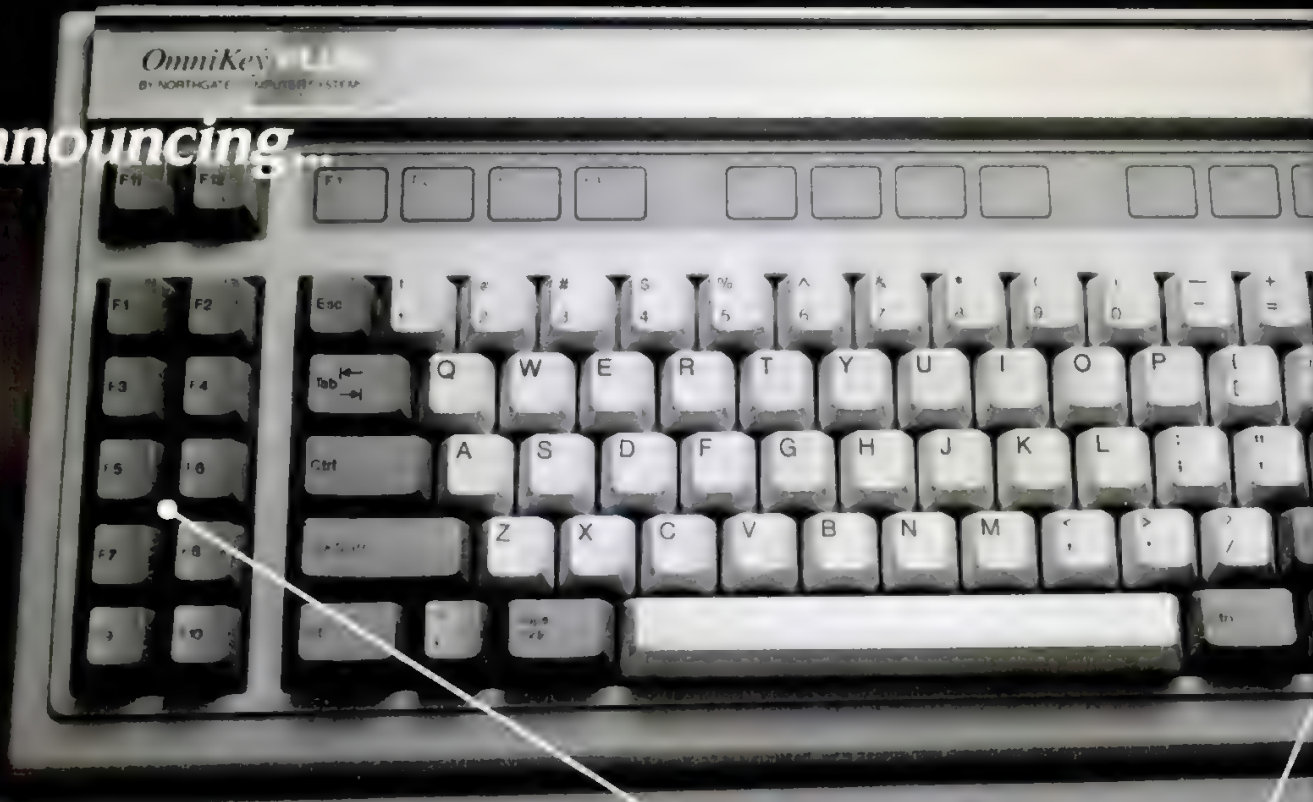
Requires: 575K RAM, hard disk, mouse, Hercules or EGA card, DOS 3.1 or later.

Syscorp
International's
MicroSTEP is the first
true PC-based
code generator
that works from
structured diagrams.

shops require. The addition of an active data dictionary would also allow for more extensive impact analysis and cross-checking reports.

Another drawback of *MicroSTEP* is that global data structures must be used for flow control in programs. This means that conditional program transfers must be implemented via a variable that is stored and updated in the global

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P.O. Box 41000, Plymouth, Minnesota 55441

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support the major phases of the SDLC, from planning through construction, and are willing to invest the money that obtaining the resources to use the *IEW* tools requires. Until other CASE vendors can migrate their products to the OS/2 Presentation Manager interface, *IEW* will be one of the only front-end tools that has a windowed graphical interface. Few other CASE products can claim the set of integrated tools that *IEW* supports, and KnowledgeWare, which recently joined forces with IBM to help create Big Blue's important Applications Development/Cycle, has delivered a solid CASE tool that offers sophisticated capabilities with a consistent graphical interface.

POSE (Picture Oriented Software Engineering)

by Andrew Topper

POSE (Picture Oriented Software Engineering), from Computer Systems Advisors, is a lower-end CASE tool that has only been on the market for a little over a year. This product was actually developed in Singapore and brought over to the U.S. in 1988; it has received much attention for making the capabilities of CASE tools available for under \$500 per module (though the price will rise if certain import tariffs are imposed). The *POSE* product line consists of three groups of products: data-modeling and database-design tools; process-modeling and -design tools; and a matrix diagrammer and prototyping tool.

The *POSE* subsystems can be purchased separately for \$595 each or for \$1,195 for four modules within groups or toolkits. The four modules sold together in the *Data Model Toolkit* are the data-model diagrammer, data-model normalizer, logical-database diagrammer, and database aid. The *Process Model Toolkit* includes the data-flow diagrammer, decomposition diagrammer, structure-chart diagrammer, and action-chart diagrammer. The screen and report prototyper and the matrix diagrammer are sold separately for \$595 each.

Access to the *POSE* modules is via a main menu that is tailored to reflect the modules purchased. When you select the

module from this menu, the specific *POSE* program is loaded and a series of pull-down menu options appears at the top of the screen. Each of the *POSE* modules shares similar pull-down menus with some standard options across all the modules.

POSE delivers solid individual tool support for data modeling, process modeling, prototyping, database design, and procedure design. The matrix-diagramming tool is especially helpful for high-level business modeling and enterprise modeling. The prototyper for screens and reports is very functional, and the database-design and -generation capabilities are also very good.

POSE allows most of the objects or entities created to be described in detail via a separate screen, and this information can be very helpful. For example, the processes identified in a data-flow diagram can be described with process IDs, names, inputs, outputs, and logic statements that are similar to process or mini specs.

Each of the *POSE* modules includes extensive reporting against the entities created, and most of the diagram types include a report writer that can be used to tailor the standard reports to the individual developer's requirements. All *POSE* modules also include utility functions such as entity/object search, diagram plotting/printing, and back up/restore.

A LEARNING EXPERIENCE

As with most of the lower-priced CASE tools, perhaps the most obvious benefit of the *POSE* modules is their relatively low

Computer Systems
Advisors says that it
plans to support the
OS/2 Presentation
Manager interface in a
future release of *POSE*.

price. Companies interested in learning about front-end CASE tools can acquire the *POSE* modules (all ten for around \$2,800 or one for around \$900) and experiment



FACT FILE

POSE, Version 4.0
Computer Systems
Advisors Inc., 50 Tice
Blvd., Woodcliff Lake,
NJ 07675; (201) 391-
6500.
List Price: \$595 per
module, \$1,195 for four
modules.
Requires: 512K RAM,
graphics adapter, 10MB
available disk space, DOS 3.0 or
later. Copy protected.
In Short: A set of ten modules that support
structured diagrams, database design, database
generation, and prototyping. Individually the
modules provide adequate support with a
somewhat cumbersome interface, but together
they lack integration, a central repository, and the
sophisticated verification checking found in
more-powerful tools.



CIRCLE 008 ON READER SERVICE CARD

with the diagram types, verification checking, and prototyping prior to selecting the final tools for their environment. In this manner, companies that are curious about CASE and structured methodologies can purchase a low-end product and use it as a learning tool for their staff.

The current *POSE* interface is nonwindowed and supports EGA graphics. The lack of support for a windowed environment means that only one diagram type can be displayed on the screen at one time. CSA says that it plans to support the OS/2 PM interface in a future release. The interface is somewhat cumbersome and often requires two selections when placing an object in a diagram. For example, to add a process to a data-flow diagram, you must select the Create option from the Action menu and then pick the entity type (Process) from the Object menu. Most CASE tools simply allow you to select the object type you want to add and then click on the diagram where it will be placed.

In addition, several of the screens prompt for keyboard input, but once the information has been entered, it remains in place until you hit the F9, or "confirm," key. It would be much easier if the mouse could be used to confirm the data entered. Several of the other *POSE* screens contain buttons that confirm or cancel an operation, and this inconsistency between screens makes the interface more difficult to learn.

DIFFICULT INTEGRATION

The fact that the nine modules are separate products and are sold individually means

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Wow.

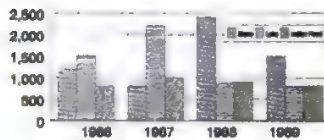
Batco Aircraft Company

Pre-Delivery Quality and Safety Checks

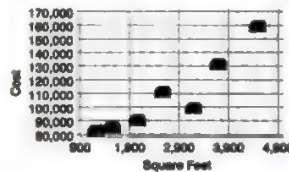


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Housing Starts by County and Year

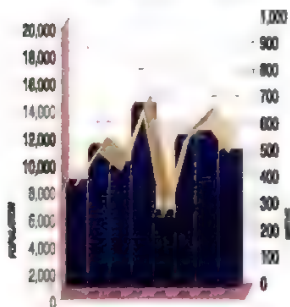


Housing Starts By Size and Price



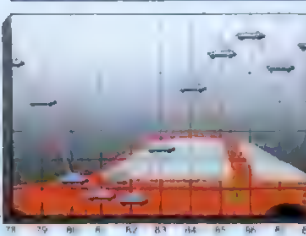
Print multiple charts on the same page.
(PostScript device)

Population Growth in Gotham



Add special effects like 3-D or color sweeps. (HP PaintJet)

U.S. Car & Truck Sales



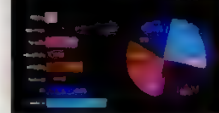
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Tropical Frags



Let your imagination run wild using the advanced drawing tools.

Breakdown of Budget



Use the 11 pre-designed color palettes for professional-looking results. (Matrix camera)

Reasons People Travel By Air

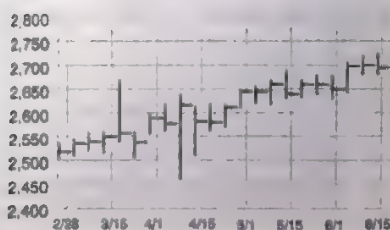
- ▲ Limited Time for Travel
- ▲ Less Expensive
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First Quarter



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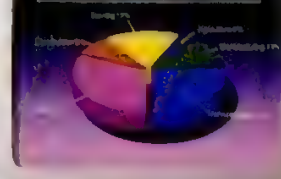
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that integrating the diagrams and object types is difficult. This results in a lack of true cross-model support and cross-diagram checking, as well as the absence of a central repository. Without a central repository, the *POSE* modules cannot provide the complete range of reports, access control, requirements traceability, and verification checking that other CASE tools offer. CSA says that it plans to give *POSE* a central repository in a future release.

Each diagram type in *POSE* must be backed up and restored with separate utility programs, and the overall verification checking between diagram types is weak or, in many cases, nonexistent. For example, while data-model (entity-relationship) diagrams can be referenced in data-flow diagrams, this information is optional. There are also currently no relationships between the data-flow diagrams and the structure charts or action diagrams within *POSE*. Since data-flow diagrams are usually deliverables from the analysis phase to the design phase, this lack of product integration can cause redundant entry and manual checking between the analysis and design phases.

Each of the modules comes with a reference manual and a tutorial guide. Some of the documents contain good introductory information on topics such as data modeling, structure-chart techniques, normalization, and process modeling. While the documentation delivered with the *POSE* modules is consistent and contains several good introductions to key techniques, the manuals themselves are packaged like paperback books. To leave a manual open to a specific page requires squashing it with whatever is handy. The manuals for most CASE products come in three-ring binders, which make it easier to reference materials.

POSE contains no change- or configuration-control capabilities, but *POSE* can be linked to *FlexGen*, a PC and minicomputer COBOL code generator from Sinc. While the current *POSE* version can be run on a LAN, this capability is limited to sharing the *POSE* programs and does not support the concurrent sharing of diagrams on a LAN.

Although the *POSE* modules deliver adequate diagramming, database design, and prototyping capabilities, their interface is cumbersome and confusing. With support for a true repository and the OS/2 PM interface due sometime in the future, *POSE* may eventually evolve into a solid low-end CASE tool. Companies that are

interested in CASE and structured techniques but that don't want to spend a fortune or don't want to be locked into a stringent, rule-based product should consider *POSE*. The product's ability to let customers pick and choose diagram types, added to its low price, should make it attractive to first-time CASE users.

ProKit*Workbench

by Andrew Topper

*ProKit*Workbench* from McDonnell Douglas is another high-end CASE tool on the market that provides many of the tools required for the analysis and design phases of the SDLC. The current version of *ProKit*Workbench*, priced at a hefty \$9,200, includes Analyzer, Data Dictionary, Data Modeler, Designer, Prototyper, and Reports modules. The product comes on 43 360K floppy disks and requires over 15MB of hard disk space when all modules are installed. But wading through the installation is worthwhile; *ProKit*Workbench* delivers a sophisticated, easy-to-use front-end CASE tool that offers many strengths and few weaknesses when compared with other products on the market.

Upon executing the *ProKit*Workbench*, you see a copyright notice quickly displayed, and the initial screen pops up; this screen shows the product serial number, to whom it is licensed, and what version is running. The developer can then exit via the F10 key or continue with the

F8, or "select," key. Another screen is then displayed showing the workstation ID and the project drive letter and asking for the project ID, user ID, and password. Once the responses have been entered and verified, the program proceeds to the main menu, where the various components are available. The *ProKit*Workbench* interface is very intuitive, and on-line help is available for menu options and most fields that require data.

MACRO REPORT WRITING

The strengths of *ProKit*Workbench* include its prototyping, dictionary-reporting and verification-checking capabilities. *ProKit*Workbench* includes a macro report-writing capability that allows the standard dictionary reports provided by McDonnell Douglas to be modified or ad-

The strengths of
*ProKit*Workbench*
include its
prototyping,
dictionary-reporting
and verification-
checking capabilities.

ditional reports to be created as required. In addition, McDonnell Douglas provides an interface to its Pro-IV Application Developer on a mainframe, as well as interfaces to *Telon* and *Transform*, third-party mainframe code generators.

Other strengths include an excellent version-control capability, with support for up to eight versions of a project at one time; a good tutorial manual, with accompanying project data on a floppy disk and an ability to generate data structures for screen and report prototypes in one of seven languages. Another nice feature found in this product is the word processing capability that is available whenever text is entered for a dictionary object. Although this facility is not comparable to full-featured word processors, it does provide block commands, import and export of text from external files, and tab settings.

*ProKit*Workbench* is not, however,



FACT FILE

*ProKit*Workbench*,
Version 1.0
McDonnell Douglas,
P.O. Box 516, St. Louis,
MO 63166, (800) 325-
1087.
List Price: \$9,200.
Requires: 640K RAM,
graphics adapter, 512K
expanded memory, 14 MB available disk space,
DOS 3.0 or later.
In Short: Good diagramming, repository, and
prototyping capabilities in a solid product that
supports LAN and PC environments. This tool
offers good verification checking, change and
configuration control, and a word processor.



CIRCLE 610 ON READER SERVICE CARD

the end-all of front-end CASE tools. It offers no current support for a shared data dictionary on a LAN, almost no support for physical database design, and sparse documentation. While *ProKit*Workbench* can be used on a LAN, any data that is shared will have to be duplicated between workstations on the network.

What documentation there is is good and includes a great index and glossary, but it seems difficult to understand how a product of this complexity could have only one manual with less than 20 pages spent discussing the designer capability. More explanation of each capability and option would only make this already good tool even easier to use and might reduce the need for training with the product.

Another easily addressed problem is that the product is delivered on over 40 360K floppy disks. By using standard IBM PC AT 1.2MB floppy disks, the 43 disks that are supplied by the company can be reduced to around 20, making installation less of a chore.

While the *ProKit*Workbench* interface is fairly consistent, at times it does not effectively use the mouse and keyboard together, causing some confusion as you program. Except when the diagram editor or the prototyper was running, I found it much easier to use only the keyboard for all of the selections I was making.

TECHNICAL SERVICES

The fact that McDonnell Douglas chose to include support for a Design data-flow diagram is interesting, and while this tool may be useful to some developers, the modifications do little to help make this process-modeling tool a good procedure-design aid. McDonnell Douglas also offers a wide range of technical services, including structured methodology training, CASE tool training, and consulting.

Even with the minor weaknesses in the current version of *ProKit*Workbench*, this product delivers a wealth of analysis and design tools that compete extremely well against the other products in the high-end CASE tool marketplace. *ProKit*Workbench* includes many capabilities not generally found in front-end CASE tools, including extensive support for version control, a macro report-writing facility, and a simple word processor built into the product. Together with the solid diagramming and verification-checking facilities, these capabilities help make *ProKit*Workbench* one of the best products currently on the market.

teamwork

by Tony Rizzo

With its multitasking and memory-management features, as well as its Presentation Manager graphical interface, OS/2 promises to be an excellent environment for implementing CASE tools. With one notable exception, however, OS/2-based CASE tools have yet to emerge. The company that has seriously focused on OS/2 is Cadre Technologies, though it has taken a somewhat unusual approach to the environment.

Cadre is best known for a collection of "big league" tools called *teamwork* which runs under Unix on Sun and Apollo machines, under VMS on DEC VAX stations, and under AIX on the IBM RT-PC. Cadre has now released a version of *teamwork*, Version 3.0 (\$4,995), that runs under OS/2 1.1. Cadre has a DOS product called *teamwork/PCSA*, but it is not based on or related to the software of its much larger sibling (though the user interfaces and general behavior of the programs are similar).

The *teamwork* software for OS/2 is supplied on 13 1.44MB floppy disks and takes about 25 minutes to set up. Depending on the subsystems and sample files loaded, it will require up to about 16MB of hard disk space, and it requires 4- to 5MB of RAM. It also requires the use of a copy protection block on the computer's parallel port.

I installed *teamwork* on an IBM PS/2 Model 80 with 4MB of RAM and running



FACT FILE

teamwork, Version 3.0

Cadre Technologies
Inc., 222 Richmond St.,
Providence, RI 02903;
(401) 351-CASE.
List Price: \$4,995.

Requires: 4MB RAM,
graphics adapter, 20MB
available disk space,
mouse, OS/2 1.1. Copy protected.

In Short: A sophisticated, single-user, OS/2-based (but not Presentation Manager-based) CASE tool whose interface remains reminiscent of mini and mainframe systems, despite the fact that it operates under OS/2.

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SOFTWARE

CASE

OS/2 1.1. The product was originally released under OS/2 1.0; that version has been superseded by Version 3.0 and was not reviewed.

Though this new release works with the Presentation Manager version of OS/2, it is not a Presentation Manager application. There is very little about *teamwork*, Version 3.0, that resembles what we are used to seeing under PM—or even under *Microsoft Windows* and DOS, for that matter. *teamwork* takes over a full-screen OS/2 session and implements its own graphical and windowing environment. In fact, it looks significantly like the interface of the *teamwork* products that run under Unix and VMS.

This is a very interesting approach, as well as an interesting design issue. One cannot find fault with Cadre for its design—when it first ported the software to OS/2, PM was not available. It had no choice but to design its own graphical interface. The new release simply makes that software compatible with OS/2 1.1. The good news is that it does have a real PM version of *teamwork* under development. For now, though, it's the *teamwork* X-Windows interface under a new setting.

ANALYSIS AND DESIGN

The analysis, design, and administrative tools that make up *teamwork* are quite impressive. Cadre offers them as modules that can be purchased separately or in any

teamwork is clearly designed for full-time use by professional systems analysts and designers working on large-scale projects.

combination desired. For the OS/2 version, they've chosen to bundle every module into one package, the sole exception being the Real Time module. Every module has its own unique tools, but each has

the common user interface described above and a collection of editors. If you know how to use one module, you will automatically know how to use the others. This commonality and tight integration has a lot going for it.

teamwork is clearly designed for full-time use by professional systems analysts and designers working on large-scale projects. It is not intended for, nor does it lend itself to, casual use. Using *teamwork* is actually somewhat misleading from a reviewer's perspective. It is easy to set up and apparently easy to use, but serious projects become complex quickly, and so does the software; like all CASE software, there is no way to make real use of it unless you become intimately familiar with it.

The Version 3.0 system consists of administrative, analysis, and design tools that cover every phase of the design cycle—from data modeling to data/control flow diagrams, to process specifications, to real-time modeling, and, finally, to the design cycle that specifies actual code modules and structure specifications. The analysis end of the system is based on the Yourdan/DeMarco methodologies. The design end implements Yourdan/Con-

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FACT FILE

MicroSTEP

SYSCORP International
9430 Research Blvd., #300
Echelon IV
Austin, TX 78759
(512) 338-5800

List Price: \$7,500*

Requires: 565K free memory;
Microsoft-compatible mouse;
Hercules or EGA graphics card;
hard disk; DOS 3.1 or 3.3.

In Short: An easy-to-use, graphics-based package that builds standalone applications in C from flowcharts you define. Not copy protected.

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- Robert L. Hummel
PC Magazine, May 16, 1989

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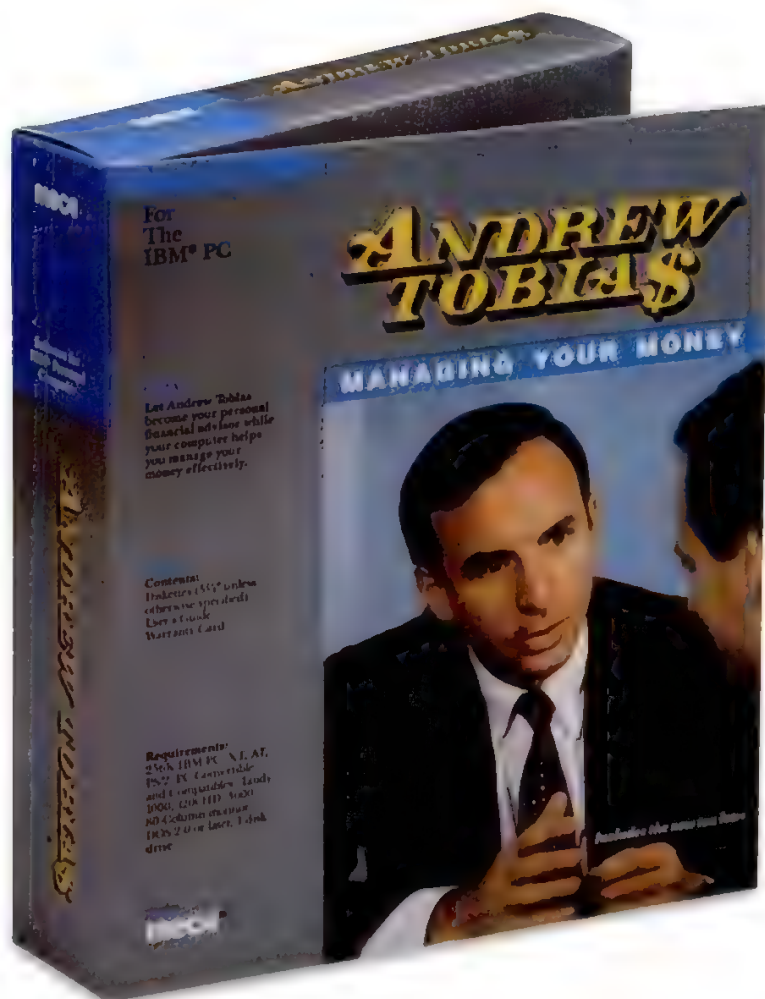


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stantine's structured design methodologies.

The administrative tools allow for extensive project control, including the customization of standard module menus. Each piece of the development cycle, and each component of every cycle, can be broken out and given to different teams and/or team members. Each piece can then be put back together to complete cycles, eventually leading to the completion of entire projects. This is big-time project management and development.

But does it work? Near as we can tell, from admittedly short-term use, yes. It all hangs together. Its chart-building and -drawing abilities are more than adequate. Windows can be overlapped or resized, and drawings can be reduced or enlarged fairly easily.

The interface, however, doesn't have the snap you're used to with *Windows* and *PM*. Performance is at times sluggish; sometimes a mouse click on a menu takes up to two seconds to register, and sometimes half a minute will go by before a window comes up. The interface definitely feels strange to this long-time *Windows* user.

teamwork will be a much better product when it has a real Presentation Manager design, but the current release is up and running—a bona fide, major OS/2 application—so it's hard to complain. *teamwork* merits, and should receive, careful attention from professional systems analysts and designers.

Visible Analyst Workbench

by Andrew Topper

At the lower end of the front-end CASE tool market is *Visible Analyst Workbench* (VAW) from Visible Systems Corp., currently consisting of four products priced at \$595 each. The modules in the product set are the Visible Analyst (diagramming tools), the Visible Rules, the Visible Dictionary, and the Visible Prototyper. VAW has enjoyed success with those companies that are looking to investigate front-end CASE tools but aren't ready to spend a lot of money or invest a lot of time.

Access to VAW is via a sign on-screen, if user security is enabled, with the user ID and password entered and verified by VAW. The main menu displays useful in-

formation, such as tools installed, product version, diagram type, project, and page size. The available options are displayed in the right-hand portion of the screen. Using

At around \$600 per module, *Visible Analyst Workbench* will let you experiment with data-flow diagramming and prototyping without having to spend a fortune on a single CASE program.

VAW does not require a lot of reading, and the package is delivered with a single operations manual and a booklet on structured analysis techniques.

Process modeling support in VAW consists of data-flow diagrams using the Gane/Sarson or Yourdon/DeMarco technique. The program also provides support for presentation and user-defined graphics that can help the developer document the system for end users and management. VAW comes with 22 defined symbols and supports up to 40 symbols. Developers can use the Custom Symbol option to create their own diagramming symbols.

The Visible Dictionary (repository) provides multiuser access and control via a LAN, user IDs, and passwords. VAW supports dictionary reporting with predefined and ad hoc reports in detailed, summary, cross-reference, and single-entity listings. Prior to adding any diagrams to the dictionary, however, the developer must choose whether diagram rule checking will be applied and what type (Gane/Sarson or Yourdon/DeMarco). Thereafter, all projects and diagrams in the dictionary must use the established rules. This inflexibility makes the package cumbersome to work with in an environment where multiple projects

are used with different rule-checking requirements.

The Visible Prototyper supports four levels of prototyping but currently provides no support for reports. The program lets you paint screen layouts, sequentially display screens, branch to other screens based on keyboard input, display data from a file, and allow end users to enter and update information. VAW's prototyping capability is a definite strong point, although the current release provides no deliverables to design and programming phases from the prototypes created.

MODULAR PRICING

Perhaps the most interesting aspect of VAW is its cost. At around \$600 per module, VAW does allow those companies that are interested in reviewing front-end CASE tools the option of experimenting with data-flow diagramming and prototyping without having to spend a fortune on a single CASE program. The tool does not, however, provide the levels of tool support and verification capability of the higher-priced CASE tools on the market.

Potential buyers should know that VAW currently provides no direct support for the design phase of the SDLC. In addition, VAW doesn't provide data and procedure design tools, such as logical database diagrams, structure charts, and action diagrams. Visible Systems has stated that an upcoming Design Workbench that has recently become available provides support for structure charts.

Also missing are data-modeling tools, such as entity-relationship diagrams or data-model diagrams, that let you describe the entities, relationships, and attributes (data elements) used in the system. Since data modeling is an important aspect of the



FACT FILE

Visible Analyst Workbench,
 Version 3.0a
 Visible Systems Corp.,
 950 Winter St.,
 Waltham, MA 02154;
 (617) 969-4100
List Price: \$595 per module.
Requires: 512K RAM, graphics adapter, 10MB available disk space, mouse, DOS 2.0 or later.
In Short: A set of four modules that support data-flow diagramming and prototyping. VAW is one of the few products that supports a shared dictionary and repository on a LAN.

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PC Magazine, February, 1989

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- Disk caching software
- LIM 4.0 support
- Dual diskette controller with dual hard drive interface
- Built-in parallel port and two serial ports
- Five available expansion slots
- 80387 math coprocessor socket
- 101-key enhanced keyboard
- 5.25" 1.2MB or 3.5" 1.44MB diskette drive

- 40MB hard drive
- Monochrome VGA monitor
- 16-bit VGA video adapter card
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Color monitor optional.

- Built-in parallel port and two serial ports
- Five available expansion slots
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- Disk caching software
- LIM 4.0 support
- ROM shadowing into faster DRAM
- Dual diskette controller with dual hard drive interface



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PC Magazine, May 30, 1989

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- 1MB fully available RAM expandable to 16MB
- Disk caching software
- LIM 4.0 support
- ROM shadowing into faster DRAM
- Dual diskette controller with dual hard drive interface
- Built-in parallel port and two serial ports
- Five available expansion slots
- 80387 math coprocessor socket
- 5.25" 1.2MB or 3.5" 1.44MB diskette drive
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- Monochrome VGA monitor
- 16-bit VGA video adapter card
- 101-key enhanced keyboard
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CompuAdd 320 Monitor And Hard Drive Options

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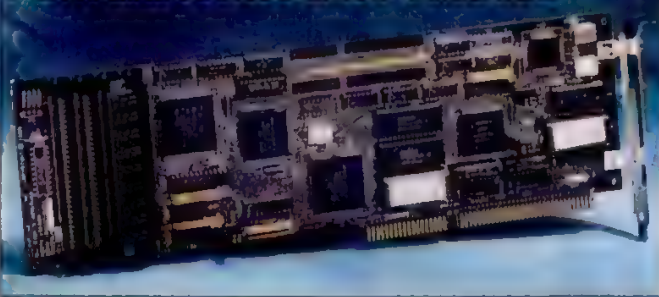
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systems analysis phase, omitting these tools limits the overall usefulness of VAW in the analysis phase.

VAW could be further improved with more-extensive diagram/model verification-checking capabilities. Currently, VAW supports syntax checking for data-flow diagrams against the Yourdon/DeMarco or Gane/Sarson methodology. However, there is absolutely no support for other, more-extensive types of verification, such as cross-diagram checking, functional-decomposition checking, and requirements-traceability checking.

VAW currently provides no direct links to third-party CASE tools (front-end and

The omission of
data modeling tools
limits the overall
usefulness of VAW in
the analysis phase.

back-end), and given its limited use in the data-modeling and design phases, this represents a definite drawback to companies that are planning to support the analysis and design phases totally. VAW also does not include any documentation-generation or version/change-control capabilities.

While VAW might be helpful to companies that are looking to investigate front-end CASE tools without spending a fortune, the tools and capabilities of the current version seem very limited. The redeeming qualities of VAW (good prototyping support, full LAN support, and small learning curve), along with the low cost, should give the package an edge with companies that are not concerned with automating all of the analysis and design tasks but that wish to introduce CASE tools and structured techniques.

Visible Systems released Version 3.1 of VAW too late for evaluation in this review. The vendor says that the new version supports Yourdon-Constantine structure charts, a systems-design diagram often used in structured design. The vendor also states that VAW will provide a higher resolution capability with support for VGA graphics and added support for expanded memory.

vsDesigner

by David Oppenheim and
Daniel Sklar

vsDesigner is an easy to learn, flexible tool that provides consistent and reliable support for the analysis and design phases of the system development process. Though it has many useful features and is generally user-friendly, *vsDesigner* would significantly benefit from the addition of certain key capabilities, improved handling of complex diagrams and a reduction in its whopping \$9,950 price tag.

Intended for use by anyone who must produce extensive design drawings, flow charts, and reports, *vsDesigner* is built around an integrated facility for creating and managing both diagrams and text. It supports a variety of design techniques, and encourages a structured approach to the design process.

In addition to diagramming and text entry, *vsDesigner* offers limited consistency/completeness checking, a data dictionary that can be shared between designs, basic design reports, and LAN support for design teams.

Visual Software also offers two modules to supplement *vsDesigner*. *vsObject Maker*, which allows you to create customized diagramming techniques, can be used to expand the range of design methods and enhance the data dictionary. *vsSQL*, which provides programmer access to the data dictionary and repository, can be used to significantly increase analysis and reporting capabilities.

There is, however, no screen or report design facility—nor any other prototyping capability—and no automatic change control.

Installation is quick and easy, requiring less than five minutes to load the 2MB of software from six floppy disks. Connecting the mouse and the security block (a parallel port pass-through connector) was just a bit trickier.

FRIENDLY INTERFACE

vsDesigner's overall interface is quite good, providing a consistent look and feel throughout the program. Graphic presentation is especially sharp in VGA, marred only by stray fragments during diagram editing. The basic menu structure is simi-

lar to that of Lotus, with alternative pop-up menu capabilities. The mouse and keyboard work well together; in fact, the mouse can be used for everything except entering text and invoking certain features that are (for some reason) only available via function keys.

On-line help is adequate, including single-line prompts in the menu and detailed explanations at the touch of a help key. Unfortunately, no on-line help is provided for specific diagramming techniques.

The documentation, including a users guide and a reference section, is complete and well written. The tutorial might have been more useful if it were not interspersed with the user's guide and if it were better coordinated with the software's default settings.

Thanks to the consistent user interface, good documentation, and helpful technical support from the vendor, *vsDesigner* is very easy to learn. You can get comfortable with the basic functions in about two days and can be working productively within a week.

Designing a system with *vsDesigner* is a straightforward affair. Starting with a blank screen, you can build diagrams from the various objects and connectors defined in the diagramming technique or syntax currently in use. Four syntaxes are supplied with the base product: Yourdon Data Flow Diagrams, Entity Relationship Models, Warnier-Orr, and Ward-Mellor. Custom syntaxes can be created, either from scratch or by modifying one of the syntaxes using *vsObject Maker*.

Placing an object or connector on the screen is as easy as typing its name and pointing with the mouse. Then, a single



FACT FILE

vsDesigner, Version 2.0
Visual Software Inc.,
3945 Freedom Circle,
#540, Santa Clara, CA
95054; (408) 988-7575.
List Price: *vsDesigner*
(with *vsSQL*), \$1,950;
vsAuthoring System
(with *vsDesigner*,
vsObject Maker, *vsSQL*), \$9,950.
Requires: 640K RAM, graphics adapter, 10MB
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keystroke brings up a text form for entering attribute information defined in the syntax for the object just drawn.

Each object in a diagram is easily decomposed by creating a new design module. Each of these nodes includes, in addition to the diagram, text files for four categories of information. (Though one of the categories is called Code, it is simply a free-form text file with no programming functionality.)

This hierarchical structure is the source of *vsDesigner's* best features. One benefit is that each node can use a different diagramming technique. For instance, a pro-

***vsDesigner* offers the basics of front-end CASE in a reliable, easy to learn implementation.**

cess in a data-flow diagram can be decomposed to a structure chart or a data store can be decomposed to an entity relationship model. A single module can also serve as the decomposition of several objects in different parent modules. Similarly, designs can be merged, and individual modules can be extracted for use in new or different designs.

Moreover, convenient zoom, pan, up-tree, down-tree and text-search functions streamline navigation through the entire design, affording ready access to text as well as graphic information.

DESIGN MODULES

It is within its design modules that *vsDesigner* has trouble. First, diagrams do not scroll. To draw beyond the current display area, you must navigate through several menus to reposition the diagram and then navigate back through those menus to continue creating and connecting design objects. By our count, it took at least seven mouse clicks to accomplish this.

Changing and rearranging diagrams also proved difficult. Moving an object by itself automatically severs all connections, which must then be reestablished one by one. Moving the connections along with the object avoids that pitfall, but the results

are very messy. Worse yet, the only way to clean up the mess is to delete and rebuild the connections one at a time—risky business without an undo function.

vsDesigner does two kinds of error checking. First, it validates the attachment of a connector (like a data flow) to an object (like a process). Unfortunately, only one end of the connector is checked at a time, so there is no way to rule out connecting one data store directly to another, for example.

The automatic balancing capability, which ensures that all data flows associated with a process are accounted for in the decomposition of that process, is of greater use. This validation even recognizes the relationship between data groups and elements, provided they are entered correctly in the data dictionary.

Far more sophisticated verification and reporting is possible with *vsSQL*, which gives standalone programs access to the design files. The two supplied with *vsDesigner* identify a number of important error conditions such as dangling connectors, isolated or improperly connected processes, and incomplete decomposition.

The data dictionary provided with *vsDesigner* is quite limited, consisting of only three text fields with no structure or editing. Although the number of fields can be increased to 16 with *vsObject Maker*, no edit criteria other than character vs. integer are supported.

NETWORKING

vsDesigner provides excellent support for design teams working on a LAN. Network support is completely transparent, allowing many users to work on the same design at the same time. While all users can view the entire design all the time, only one user is allowed to modify a given node at any one time.

By itself, *vsDesigner* offers the basics of front-end CASE in a reliable, easy to learn implementation. Augmented by *vsObject Maker*, *vsSQL* and your own fancy programming *vsDesigner* can provide impressive flexibility, sophisticated validation, analysis and reporting. Even with all the stops pulled out, however, *vsDesigner* falls short of our expectations for a PC-based design and analysis tool. Adding screen and report layout, change control, and more on-line validation in combination with an improved diagram editor would be a big step in the right direction. ■

EDITOR'S CHOICE

- Low-priced: *Visible Analyst Workbench*
- High-priced: *Decide based on your specific needs*

Visible Analyst Workbench is the best of the lower-priced CASE packages. Like *POSE*, with which it is price competitive, *VAW's* feature set is somewhat limited but its shared repository on a network is a significant plus, and its diagramming and prototyping capabilities are strong. The next version of *VAW*, already available, includes procedure design, making it even stronger. At \$595 per module, it's a good deal.

It's almost impossible to choose one winner among the more "full-featured" CASE packages. The software is so expensive that most developers avoid throwing their money away by first listing the functions that are essential to their work, then narrowing the field to two or three programs that fill their needs and pilot-testing all of them for up to 90 days before choosing one to buy. Good advice.

Three packages do, however, stand out.

DesignAid is most notable for its ease of use, however relatively that phrase must be read considering the complexity of all these programs. Some of its drawing capabilities are cleverly automated, and both the validation tools and dictionary are good.

Excelsator, by far the market leader, is supported by a number of third-party add-ons. Its dictionary capabilities, diagramming tools, prototyping tools, and documentation generation capabilities are all strong. On the negative side, it has no LAN support for a shared dictionary, no version control, and a limited database design tool.

*ProKit*Workbench* has excellent prototyping, diagramming, dictionary reporting, and verification capabilities. Like *Excelsator*, though, it doesn't support a shared dictionary on a LAN. It has no physical database design tool, and its documentation could be much better than it currently is.



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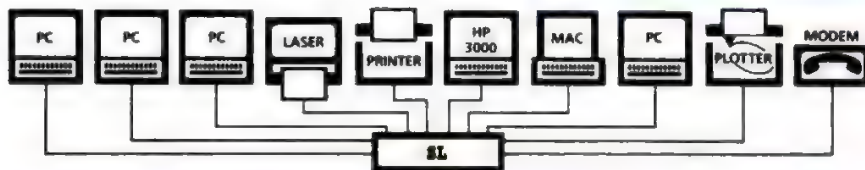
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by
Neil J. Rubenking

Lab Notes

San Francisco is everyone's "second favorite" city—the place you love just less than your own hometown. In the same way, the DOS batch language is everyone's second favorite programming language. Whether you program in assembler, in your word processor's macro language, in Pascal, or in one of the database languages, there's always a place where a batch program is just what you need to make your work easier.

The DOS batch language has major limitations, of course. It was never intended to replace high-level programming languages. But don't sell it short. When you write a batch program, you really *are* programming, and applying standard programming techniques will help you write better batch files.

The BATCHMAN program presented in this issue's Utilities column significantly extends the capabilities of the DOS batch programming language. In addition to general enhancements, it gives you fancy input/output functions, routines to return information about your system, and several unique utilities. If you have not done so already, I recommend that you read Michael Mefford's explanation of the various BATCHMAN commands in the Utilities column before continuing here.

This Lab Notes will go into the specifics of batch programming itself and will also show BATCHMAN in action.

DATA TYPES AND VARIABLES

Programs almost always need to store and reuse information. In the batch language, data is stored in *environment variables*, which I'll call *e-vars*. Most programming languages distinguish between different *types* of variables: character strings, integer numbers, floating-point numbers, and so on. The batch language doesn't distinguish between variable types: every e-var is simply a series of characters that is stored in an area of RAM called the environment. Since e-var names are limited only by the length of the DOS command line, you can use descriptive names, like

Sharpening Your DOS Batch File Programming Skills

■ Combining the BATCHMAN program in this issue's Utilities column with some proven programming techniques can take you beyond many of the usual limitations of the batch file language.

DestinationDrive, for e-vars. The only reason not to do so is that both the name and the value of every e-var take up precious space in the fixed-size environment. If you're going to do a lot of batch programming, you should expand the amount of RAM DOS sets aside as the environment.

The default environment size in DOS 3.2, 3.3, and 4.0 is 160 bytes. You can make the size anything from 160 to 32,767 bytes by putting a SHELL= line in your CONFIG.SYS. The syntax is

```
SHELL=d:\COMMAND.COM /E:### /P
```

where *d:* is the drive and directory that holds your COMMAND.COM file and *###* is the number of bytes you want reserved for the environment. DOS will round the number of bytes to the next higher multiple of 16.

The procedure is slightly different if you're using DOS 3.1. In 3.1 the default environment size is 128 bytes, and *###* in the SHELL= line should be the desired

number of 16-byte paragraphs to be set aside for the environment. The allowable *###* entry for DOS 3.1 ranges from 11 (176 bytes) to 62 (992 bytes). Unfortunately, with DOS versions before 3.1, the only way to expand the environment is to patch COMMAND.COM, and the patch differs for every version.

You create e-vars with the DOS SET command. Try it by entering

```
SET MyVar=PCmagazine
```

at the DOS prompt. Now enter just the SET command alone. This will display the current contents of your environment. You'll probably see entries there for COMSPEC, PATH, and PROMPT in addition to MYVAR. Note that DOS has capitalized MYVAR, while it has allowed PCmagazine to remain in mixed case, just as you entered it.

Within a batch file, you can get access to the contents of an e-var by surrounding it with percent signs. For example, the line

```
ECHO %PATH%
```

in a batch program will write your current PATH to the screen. Don't try this from the command line, however: it works only within batch programs. When your program is finished using an e-var, it's good practice always to clear it by SETting it to nothing; for example:

```
SET MyVar=
```

Clearing an e-var frees the number of bytes

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its name and contents occupy in the environment, giving you more space in which to work.

EXPRESSIONS AND ASSIGNMENTS

In most programming languages, you can perform a calculation and assign the result to a variable. For example, you could assign the sum of Y and Z to the variable X with the statement `LET X=Y+Z`. Unfortunately, there's no way to do arithmetic on e-vars in a batch program. The only expressions possible involve combining strings of characters. Thus, if e-vars Y and Z contain `C:\DOS\` and `BATCHMAN.COM`, respectively,

```
SET X=Y+Z
```

will give e-var X the value

```
C:\DOS\BATCHMAN.COM.
```

The batch language does permit you to make an indirect assignment to a variable whose name is stored in another variable. Suppose, for example, that your batch file contains these two commands:

```
SET SLOT=Slot1
SET %SLOT%=%PATH%
```

The second line assigns the current PATH

string to the e-var Slot1. You might use such a scheme to save the PATH in the next available slot so as to save and restore your PATH at several levels. Note, however, that you can't use indirection on the right side of the equals sign. Thus,

```
SET PATH=%SLOT%
```

won't set your PATH to the value stored in the current slot—instead, your PATH will simply become `%SLOT%`.

ORGANIZING SPAGHETTI

Some programming languages are inherently structured, others are not. In Pascal and Modula-2, for example, the design of the language itself makes it easy to break down a programming task into several self-contained procedures. When the program calls on one of these routines, it saves the calling address, and when the routine finishes, it transfers control to the instruction following the procedure call. The DOS batch language, by contrast, is almost completely unstructured. Program execution simply proceeds one line after another, except when a GOTO jumps to a label elsewhere in the program. One consequence of this is that, unless you comment your batch programs thoroughly, following a program's execution may be just as difficult as tracing one strand in a plate of spaghetti.

Since batch programs are generally small, however, their lack of structure is rarely a problem. If necessary, you can de-

vise subroutines that return control to the calling location, as illustrated by the SUBROUTN.BAT listing in Figure 1. You just have to do by hand what a high-level language would do automatically. Each subroutine call requires three batch lines. Let's consider the essential lines of a call in reverse order: the third line is an *anchor* label to which the subroutine will return; the second line is a GOTO command that jumps to the subroutine; and the first line sets the e-var RETURN to the name of the anchor label. At the end of the subroutine, the command

```
GOTO %RETURN%
```

jumps to the anchor label.

You can also keep frequently used sets of batch commands in separate batch files and call them as needed. In DOS 3.3 and later, the CALL command will run another batch program and return to the calling batch program. Your batch file might, for example, contain the line

```
CALL SAVEPATH
```

With DOS versions earlier than 3.3, you must call COMMAND.COM with the /C switch; for example:

```
COMMAND /C SAVEPATH.BAT
```

The COMMAND /C method presents one additional problem: you can't use it for any batch file that depends on manipulating e-vars. That's because the secondary command processor invoked by COMMAND /C gets its own copy of the environment. Any environment changes made by the batch program will affect only *that* copy, and when the program ends, that copy of the environment disappears. The CALL command in DOS 3.3 eliminates this problem—a real advantage for batch programmers.

CONTROLLING PROGRAM FLOW

A batch program can be more than a list of instructions for DOS to execute in sequence. Batch files can make decisions. If a particular condition is true, the program executes a selected command. If false, it goes ahead to the next line. The IF command in the batch language tests for three kinds of conditions: file existence, identity between two character strings, and the ERRORLEVEL value returned by a previous command.

The existence test for a given filespec

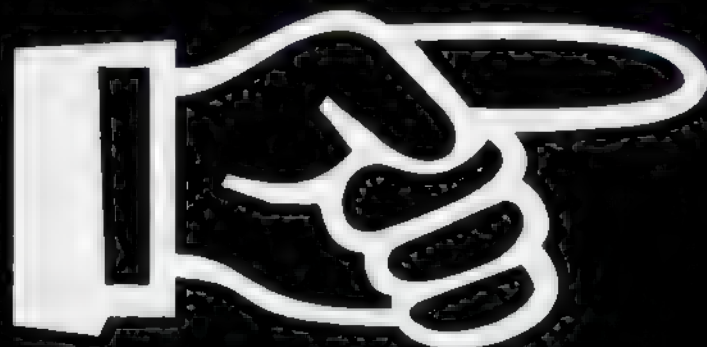
SUBROUTN.BAT	COMPLETE LISTING
<pre>@ECHO OFF SET myvar=joker REM ---v--- Put the name of the return label in e-var "return" SET return=ret1 REM ---v--- Now jump to the subroutine GOTO sub REM ---v--- When the subroutine ends, it will jump to this label :ret1 SET myvar=penguin SET return=ret2 GOTO sub :ret2 SET myvar=riddler SET return=ret3 GOTO sub :ret3 ECHO That's all! GOTO end REM ----- This is the subroutine -- when finished it jumps to REM ----- the label whose name is stored in e-var "return" :sub ECHO The current value of myvar is "%myvar%" PAUSE GOTO %return% :end</pre>	

Figure 1: You can put subroutines in your batch programs by storing their return addresses in e-vars. A subroutine's anchor label returns control to the location specified in the previous call.

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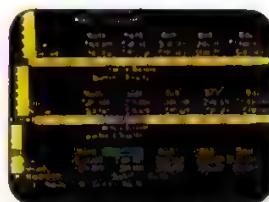
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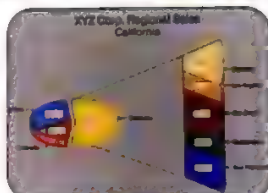
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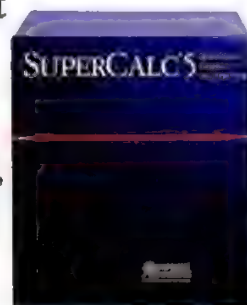
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can be illustrated thus:

```
IF EXIST *.BAT ECHO Yes!
```

This will display Yes! on the screen if there are any batch files in the current directory. You can't use the IF EXIST command to test for a valid directory directly, but you can get around this limitation by checking the existence of NUL in that directory. The NUL device always exists, so the only way

```
IF EXIST subdir\NUL
```

can be false is if the subdirectory doesn't exist.

The comparison test,

```
IF string1==string2
```

is true if the two strings are identical, including upper- and lowercase. Note that in comparisons involving command-line parameters or e-vars, it's good practice to surround the strings with quotes—otherwise an empty string could cause a syntax error. Common uses include testing for the existence of a parameter, as in

```
IF NOT "%1"==" " GOTO OK
```

and testing e-vars against specific values, as in

```
IF "%Debug%"=="YES" ECHO ON
```

ERRORLEVEL

The all-important IF ERRORLEVEL command lets .COM and .EXE programs communicate with batch programs. Any .COM or .EXE program can set an exit code when it ends, and that code becomes the ERRORLEVEL until another program changes it. The

```
IF ERRORLEVEL n command
```

returns true if the ERRORLEVEL (which I'll abbreviate to EL) is $\geq$ (greater than or equal to) the number n . Note that a nonzero EL does not imply that there is an error in the program: most of the BATCHMAN commands routinely return information via the EL.

The IF ERRORLEVEL test only lets you know that the EL is $\geq$ the number tested. If you want to test for a specific EL

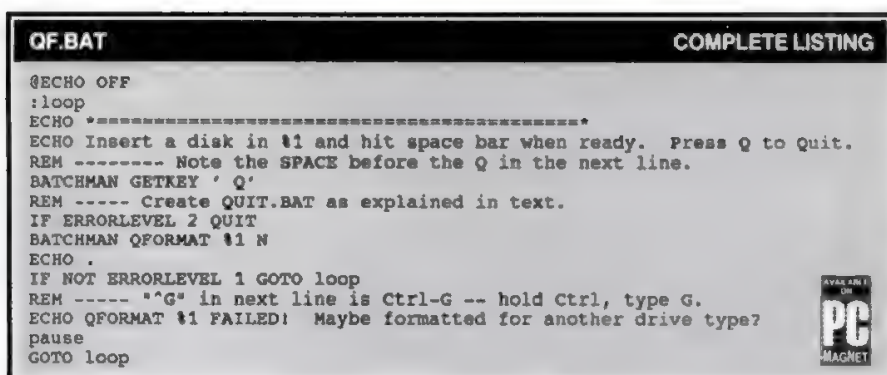


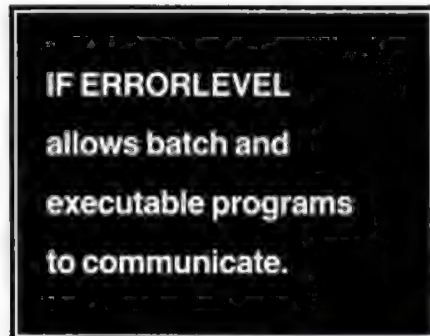
Figure 2: This batch file makes use of BATCHMAN's QFORMAT command to wipe out all files and subdirectories on the diskette in drive A or B, as designated.

number, you must make two tests. The first checks that the EL is $\geq$ the number, and the second checks that it is not $\geq$ the next higher number. For example, to test for an EL of exactly 9, you would use

```
IF ERRORLEVEL 9 IF NOT ERRORLEVEL
10 ECHO EL is exactly 9
```

GOING AROUND IN CIRCLES

To make a loop in a batch file, just insert a label followed by a GOTO command that jumps back to that label. Any lines you put



between the GOTO and the label will be executed again and again, so you'll also want to provide a way to get out of the loop. The exit usually looks like

```
IF condition GOTO outofLoop
```

Thus, for example, if the loop contains a program that signals an error by returning a nonzero EL, you might use

```
IF ERRORLEVEL 1 GOTO outofLoop
```

QF.BAT, shown in Figure 2, uses a loop to keep quick-formatting diskettes until you tell it to stop. You supply the A or B: when you enter QF. Note that QF.BAT—and several other of these ex-

ample batch files—makes use of a 1-byte file called QUIT.BAT. You can create QUIT in your batch directory with the command REM>QUIT.BAT.

You can use an environment variable to make a loop repeat a set number of times, as follows:

```
SET X=
:start
SET X=%X%
ECHO One time through the loop
IF "%X%"=="!!!!!" GOTO outofLoop
GOTO start
:outofLoop
```

The batch lines above will repeat five times. Note that indenting the lines within a loop helps make your batch file easier to read.

The FOR command produces a different kind of loop. Its syntax is

```
FOR %v IN (list) DO command
```

You can use any single letter preceded by two percent signs, as in the %v above, to designate a variable. The FOR loop executes the command once for every element on the list, and if the variable appears in the command's parameters, it will be replaced by each element in turn. For example,

```
FOR %v IN (one two three) DO ECHO
An' a %v
```

will write the lines "An' a one", "An' a two", "An' a three" to the screen. Note that you can also use FOR at the DOS command line, but in that case you precede the FOR variable letter with one percent sign, not two.

If any item in the list of FOR parameters is a filespec that contains wildcards, the FOR command will expand it into all

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of the matching filenames. Try this at the command line:

```
FOR %f IN (*.BAT) DO ECHO %f
```

This will ECHO the names of all batch files in the current directory.

One restriction is that you can't nest FOR loops. The line

```
FOR %x IN (0 1) DO FOR %y IN (0 1)
DO ECHO %x%y
```

will not print out 00, 01, 10, and 11. The only way to use one FOR loop "inside" another is to call the inner loop using a secondary command processor. Thus, you could, for example, use the line

```
FOR %x IN (0 1) DO COMMAND /C FOR
%y IN (0 1) DO ECHO %x%y
```

You can use the same technique to perform several commands on each item in the list. Just use COMMAND /C or CALL to run another batch file that processes each item. INFO.BAT, listed in Figure 3 and shown in Figure 4, uses a FOR loop that calls the batch file DRIVINFO.BAT in Figure 5 to test for the existence of each possible drive letter from A: to Z:.

One caution about combining FOR loops with DOS redirection is quite necessary. DOS sets up the redirection once, before running through the FOR loop; consequently, you should always follow this simple rule: never put the FOR variable on the right side of any redirection symbol (<, >, or |).

"FOR" AS A CASE STATEMENT

Two especially clever uses of the FOR command involve using the EL with labels. Suppose you want a batch file that will perform one of three different actions depending on whether you pass it A, B, or C as a command-line parameter. You could begin your batch file with the lines

```
FOR %v IN (A B C a b c) DO IF
"%v"=="%v" GOTO Label%v
ECHO Error: Please enter A, B, or C.
:LabelA
```

This creates the equivalent of a Pascal

INFO.BAT1 of 2PC MAGNET

```
@ECHO OFF
REM ----- Display a nice boxed header for the info report
BATCHMAN CLS 1Eh
BATCHMAN WINDOW 1,1,80,3,1Ch,=
BATCHMAN SETCURSOR 2,23
BATCHMAN CECHO 1Ch,BATCHMAN'S SYSTEM INFO REPORT
BATCHMAN SETCURSOR 5,1
REM ----- Now let's have some info about memory
BATCHMAN CECHO C 1Eh,ROM BIOS data :
BATCHMAN ROMDATE
BATCHMAN CECHO C 1Eh,Main memory :
BATCHMAN MAINMEM R
BATCHMAN CECHO C 1Eh,extended memory :
BATCHMAN EXTMEM R
BATCHMAN CECHO C 1Eh,expanded memory :
BATCHMAN EXPMEM R
REM ----- Display the DOS version
BATCHMAN CECHO C 1Eh,DOS version is :
BATCHMAN DOSVER
IF ERRORLEVEL 64 GOTO 2ormore
BATCHMAN CECHO 1Ch,less than 2.0
GOTO cpu
:2ormore
IF ERRORLEVEL 96 GOTO 3ormore
BATCHMAN CECHO 1Ch,2.x
GOTO cpu
:3ormore
IF ERRORLEVEL 128 GOTO 4ormore
BATCHMAN CECHO 1Ch,3.x
GOTO cpu
:4ormore
BATCHMAN CECHO 1Ch,at least 4.0
REM ----- Determine the CPU type
:cpu
BATCHMAN CECHO C 1Eh,CPU type :
BATCHMAN CPU
FOR %v IN (0 1 2 3 4) DO IF ERRORLEVEL %v GOTO cpu%v
:CPU0
BATCHMAN CECHO 1Ch,unknown
GOTO break
:CPU1
BATCHMAN CECHO 1Ch,8086/8088
GOTO break
:CPU2
BATCHMAN CECHO 1Ch,80186
GOTO break
:cpu3
BATCHMAN CECHO 1Ch,80286
GOTO break
:cpu4
BATCHMAN CECHO 1Ch,80386
REM ----- Is ANSI loaded? Is BREAK on?
:break
BATCHMAN CECHO 1Eh,
BATCHMAN CECHO C 1Eh,BREAK :
BATCHMAN BREAK
IF ERRORLEVEL 1 GOTO breakon
BATCHMAN CECHO 1Ch,OFF
GOTO ansi
:breakon
BATCHMAN CECHO 1Ch,ON
:ansi
BATCHMAN CECHO C 1Eh,ANSI :
BATCHMAN ANSI
IF ERRORLEVEL 1 GOTO noansi
BATCHMAN CECHO 1Ch,loaded
GOTO drives
:noansi
BATCHMAN CECHO 1Ch,not loaded
:drives
REM -----
REM We use a FOR command and an auxiliary batch file to
REM list the available drives in the system.
REM -----
BATCHMAN CECHO 1Eh,
BATCHMAN CECHO 1Eh,The drive test takes a little time -- don't worry.
BATCHMAN CECHO C 1Eh,Drives :
FOR %v IN (A B C D E F G H I J K L M) DO CALL DRIVINFO.BAT %v
FOR %v IN (N O P Q R S T U V W X Y Z) DO CALL DRIVINFO.BAT %v
```

Figure 3: This makes use of several BATCHMAN utilities to give you a status report on your system. INFO.BAT returns data on such items as the number of drives and the amount of memory.

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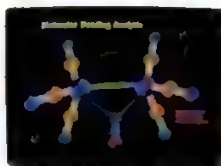
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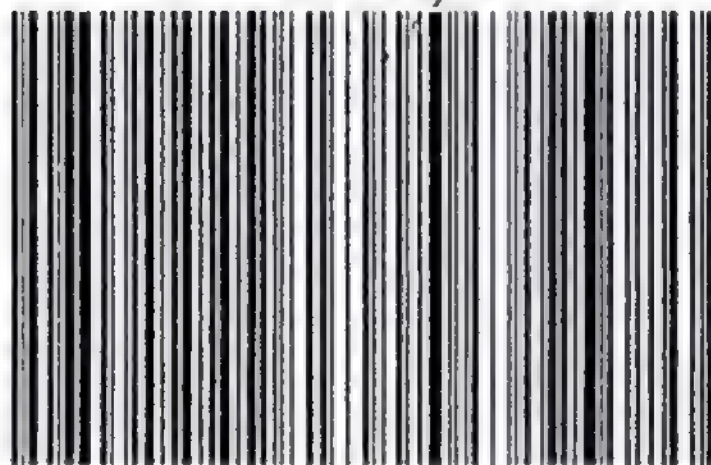


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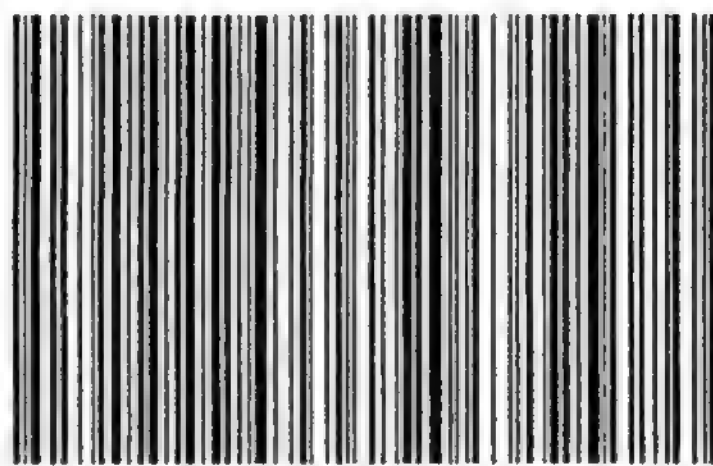
Gbs5lipBack-001B



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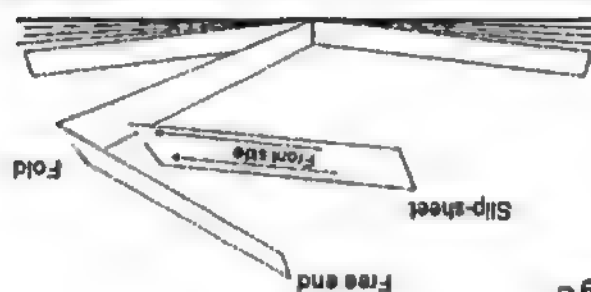
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Folded edge of the page



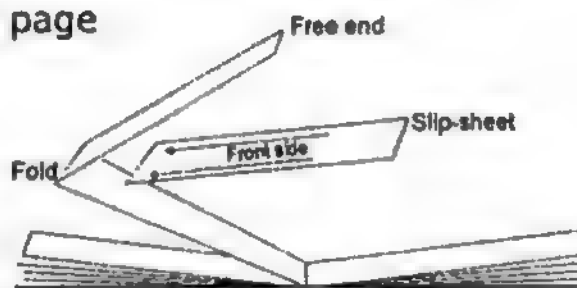
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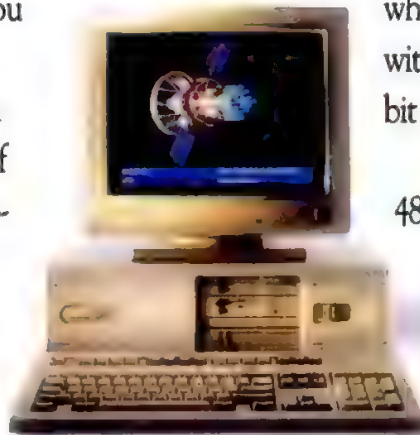
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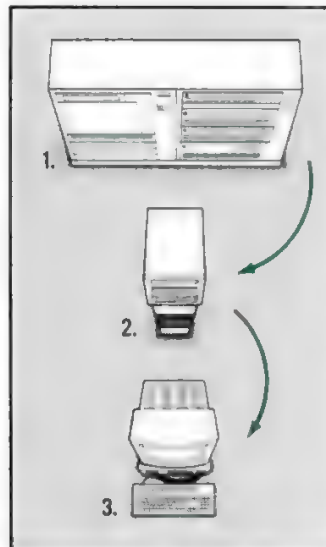
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Lab Notes

```

INFO.BAT                                     2 of 2
BATCHMAN CECHO 1bh,
BATCHMAN CECHO 1bh,
REM ----- Now let's get some info about your video.
BATCHMAN CECHO C 1bh,Video adaptor :
BATCHMAN display
FOR %tv IN (1 2 3 4 5 6 7 8 9 10 11 12 13) DO IF errorlevel %tv GOTO vid%tv
:vid3
:vid9
:vid10
BATCHMAN CECHO 1ch,Unknown
GOTO vidmode
:vid1
BATCHMAN CECHO 1ch,Monochrome
GOTO vidmode
:vid2
BATCHMAN CECHO 1ch,CGA
GOTO vidmode
:vid4
BATCHMAN CECHO 1ch,EGA color
GOTO vidmode
:vid5
BATCHMAN CECHO 1ch,EGA mono
GOTO vidmode
:vid6
BATCHMAN CECHO 1ch,VGS
GOTO vidmode
:vid7
BATCHMAN CECHO 1ch,VGA mono
GOTO vidmode
:vid8
BATCHMAN CECHO 1ch,VGA color
GOTO vidmode
:vid11
BATCHMAN CECHO 1ch,MCGA mono
GOTO vidmode
:vid12
BATCHMAN CECHO 1ch,MCGA color
:vidmode
BATCHMAN CECHO C 1bh,Video mode # :
BATCHMAN VIDEOMODE /R
BATCHMAN CECHO 1bh,
BATCHMAN CECHO C 1bh,Rows in display :
BATCHMAN ROWS /R
BATCHMAN CECHO 1bh,
BATCHMAN CECHO C 1bh,Cols in display :
BATCHMAN COLS /R
REM -----
REM Now we get fancy with the ending. First we hide the cursor,
REM then we set up a loop for 10 repetitions. In this loop,
REM we display "Press any key!" in a window of one color,
REM wait one second, and then display it in another color. If
REM the user presses a key, we hop out. Otherwise, the display
REM ends after 10 loops.
REM -----
BATCHMAN CURSORTYPE 32,32
BATCHMAN SETLOOP 10
:loop
BATCHMAN WINDOW 21,33,14,3,4bh,=
BATCHMAN SETCURSOR 22,34
BATCHMAN CECHO C 4bh,Press a key!
BATCHMAN BEEP 523,1
BATCHMAN WAITFOR 1
IF ERRORLEVEL 1 GOTO end
BATCHMAN WINDOW 21,33,14,3,3ch,=
BATCHMAN SETCURSOR 22,34
BATCHMAN CECHO C 3ch,Press a key!
BATCHMAN BEEP 392,1
BATCHMAN WAITFOR 1
IF ERRORLEVEL 1 GOTO end
BATCHMAN DECLOOP
IF ERRORLEVEL 1 GOTO loop
:end
BATCHMAN SETCURSOR 25,1
BATCHMAN CURSORTYPE

```

She's 5 years old.
She's already had
7 names,
16 identities and
21 homes.



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Lab Notes

CASE statement or the C SWITCH statement. Note that the GOTO command finds the appropriate label regardless of whether it is upper- or lowercase.

INFO.BAT (Figure 3) uses FOR to create a different kind of CASE statement. This one jumps to the label that matches

the current EL value. The command is

```
FOR %v IN (0 1 2 3 4) DO IF
ERRORLEVEL %v GOTO cpu%v
```

To see how this works, suppose the EL is 2. DOS tries the numbers 0 through 4 in the IF ERRORLEVEL test. The EL is $\geq$ 0, so the command GOTO cpu0 seemingly should execute. However, DOS has to finish the FOR loop before going on. The IF

test comes up true with 1 and 2 also, thus leaving the command GOTO cpu2 pending. The EL 2 is less than both 3 and 4, so the pending command doesn't change. When the FOR loop is completed, control jumps to the label cpu2. Note that the numbers in the FOR parameter list must obviously be in ascending order.

It's frequently useful to turn the EL into an e-var. Here, the command would be

```
FOR %v IN (0 1 2 3 4) DO IF
ERRORLEVEL %v SET cpu=%v
```

For each value from 0 to 4, this line sets the e-var cpu to that value if the EL is greater than or equal to it. That's true for 0, 1, and

To repeat a command
many times, put it
in a FOR loop with
multiple parameters.

2, but it isn't true for 3 and 4. So the e-var finishes with the value 2. Now you can GOTO a label that is named after that e-var, pass it as a parameter to another command, ECHO it to the screen—whatever you need to do.

The FOR loop shown above tests only for an EL value from 0 to 4. Any larger value registers as 4. ERRLEV.BAT, listed in Figure 6, shows how to put any EL value from the entire range (0 to 255) into an environment variable. Run ERRLEV.BAT after any program that returns an EL and it will insert the numeric EL value into the e-var EL. For example, BATCHMAN.COLS normally returns an EL of 80. Running ERRLEV right after this command sets the e-var EL to 080.

You can repeat a single command many times by putting it in a FOR loop with many parameters. To execute the same command 20 times, you can just put 20 X's in the FOR list, as in

```
FOR %v IN (X X X X X X X X X X
X X X X X X X X) DO command
```

There's a limit to the length of the list you can fit on the DOS command line, of course, and moreover you can execute only one command. As we'll see below,



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Lab Notes



Figure 4: With just one command, INFO.BAT, you can display the current system status, which actually is gathered by several small batch files.

BATCHMAN offers an alternate method that lets you repeat a series of commands any number of times from 1 to 255.

INPUT/OUTPUT

Most programs need to communicate with the "outside world," both to receive data and instructions and to return their results. Batch files are no exception, though their communication channels are limited. Basic batch input must come strictly from command-line parameters, and the ECHO command provides basic output. There's no built-in way to take user input during a batch file.

You can feed a batch file as many command-line parameters as will fit on the command line, however. If your program requires no more than nine, you can designate them as %1 through %9 (parameter %0 is the batch file's name). In fact, by using the SHIFT command, it is possible to use more than nine parameters on one command line. SHIFT moves each parameter to the next lower parameter and gives parameter %9 the next value waiting on the command line. The tiny batch file that follows will echo back each parameter on a separate line.

```
@ECHO OFF
:loop
IF "%1"==== GOTO end
ECHO %1
SHIFT
GOTO loop
:end
```

You can use the parameters to control

what happens in the batch file, as in

```
COPY %1 %2
```

or

```
IF "%1"=="Go" GOTO begin
```

It is important to remember, however, that

the string comparison IF test is case sensitive. If you entered "go", "gO", or "GO", the test above would return false. You could test for all four possibilities, but what if the parameter were a longer string like "motivate", which presents some 256 possibilities?

SYNONYMS.BAT, shown in Figure 7, illustrates one handy way to allow variations in batch file parameters. Abbreviations, variations in case, and even completely different words are possible. If your batch parameter matches any of the synonyms of a main parameter, the batch program reexecutes itself using the equivalent main parameter. Once past the synonym-handling lines, the batch program has only to deal with the main parameters. In the example, the main parameters are BIG and LITTLE, but HUGE and TINY are equally acceptable. You can abbreviate any of the parameters to the first letter, and you can spell them using all capital letters, all small letters, or a mix with only the first letter capitalized.

The ability to accept variations in command-line input is especially important when you're writing batch programs to be used by many other people. There's always the chance someone will enter "BIg" or "tINy" rather than one of the

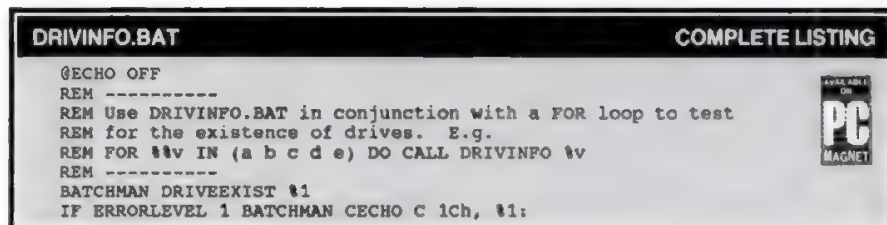


Figure 5: With the assistance of a FOR loop, INFO.BAT calls DRIVINFO.BAT to test for the existence of every possible drive letter on your hard disk.

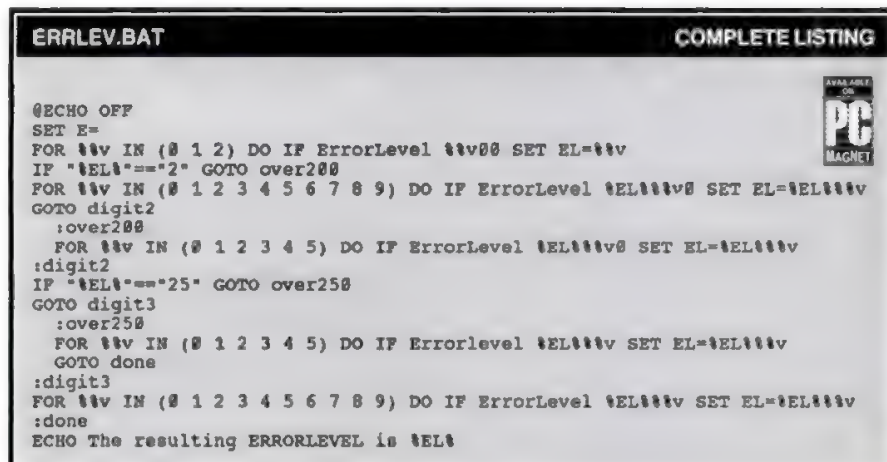


Figure 6: Some commands, such as the FOR loop, only return an EL between 0 and 4. To display ERRORLEVEL as a three-digit number, run ERRLEV.BAT.

Lab Notes

synonyms. You can eliminate case sensitivity completely by switching to a kind of comparison in which case isn't important. NOCASE.BAT, listed in Figure 8, shows you how. You start by setting an e-var named for the parameter in question to an unusual value. Then you check to see if an e-var named by the test string has that value. Case is unimportant in e-var names, since DOS converts them all to uppercase anyway. This is an odd technique, but studying the example should make it clear.

The normal DOS batch language doesn't provide for user input during batch file execution. The PAUSE statement will halt the batch file execution until you press a key, but it can't tell *which* key you press. To transcend this limitation, most sophisticated batch files use a utility such as BATCHMAN's GETKEY function, which gets keyboard input and returns an EL that can be used within the batch file.

If you're willing to live dangerously, however, you can go beyond using ELs and take input from ordinary DOS commands. You can even take whole words or phrases instead of GETKEY's single characters. GETREPLY.BAT in Figure 9 shows how. Before you can use GETREPLY, you must create a file called ANSWER.DAT. ANSWER.DAT contains nothing but the characters "SET answer=", with no carriage return, line feed, or end-of-file marker. To create it, use the following DEBUG script:

```
DEBUG ANSWER.DAT
E100 'SET answer='
RCX
B
W
Q
```

Now you can try GETREPLY. Run it and type something on the response line, then hit Ctrl-Z and Enter. The risk involved in this technique is that the user might ignore the instructions and type more than one line. In that event, DOS would attempt to execute the lines after the first, with unpredictable results.

Basic batch output consists of little more than ECHOing messages, TYPEing files, and using CLS to clear the screen. You can echo ANSI commands to change colors or position the cursor if you can be certain that ANSI.SYS will be loaded.

Note that BATCHMAN can also detect not only ANSI.SYS, but also Mefford's much better ANSI.COM. For a discussion of the latter's capabilities, see the Utilities column in our January 31, 1989, issue.

SPEEDING UP BATCH PROGRAMS

Compared with compiled programs, batch programs execute very slowly. DOS reads

and processes the batch file one line at a time. If a line says to GOTO a label, DOS must scan the whole program to find that particular label. Moreover, while REM statements help you remember what different parts of your batch program do, DOS has to read each REM line in order to decide that it isn't a command.

If you value speed more than disk

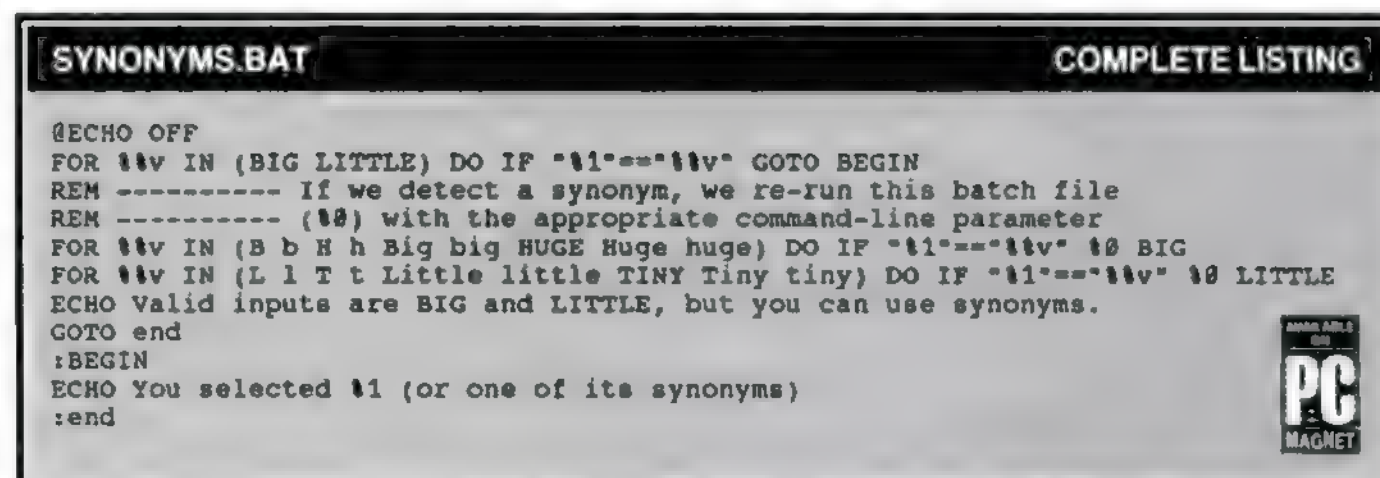


Figure 7: You can enter many variations on the parameters for this batch program, but internally it has to deal with only two.

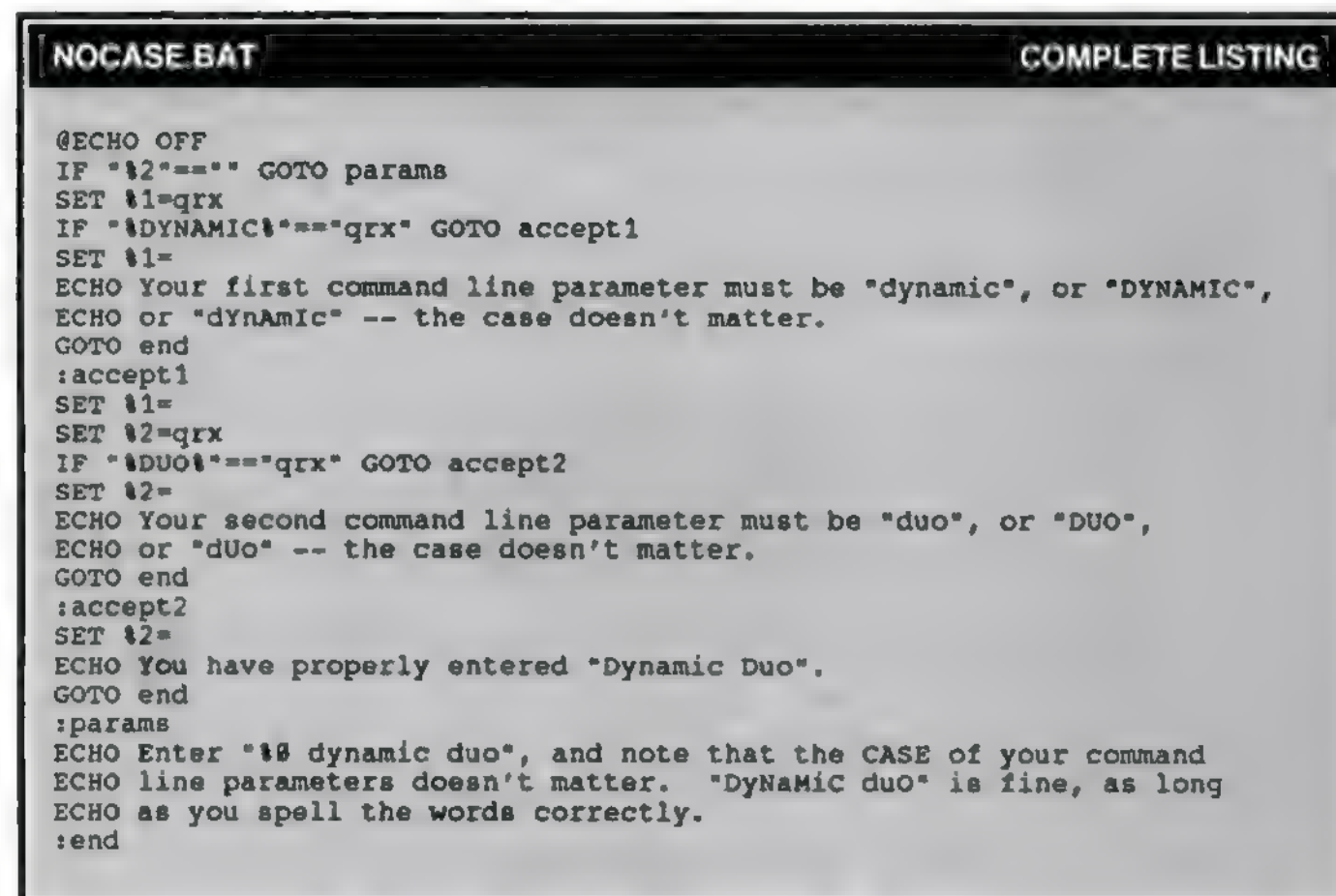


Figure 8: DOS doesn't care about upper- and lowercase in e-var names, which is what allows this batch program to work.

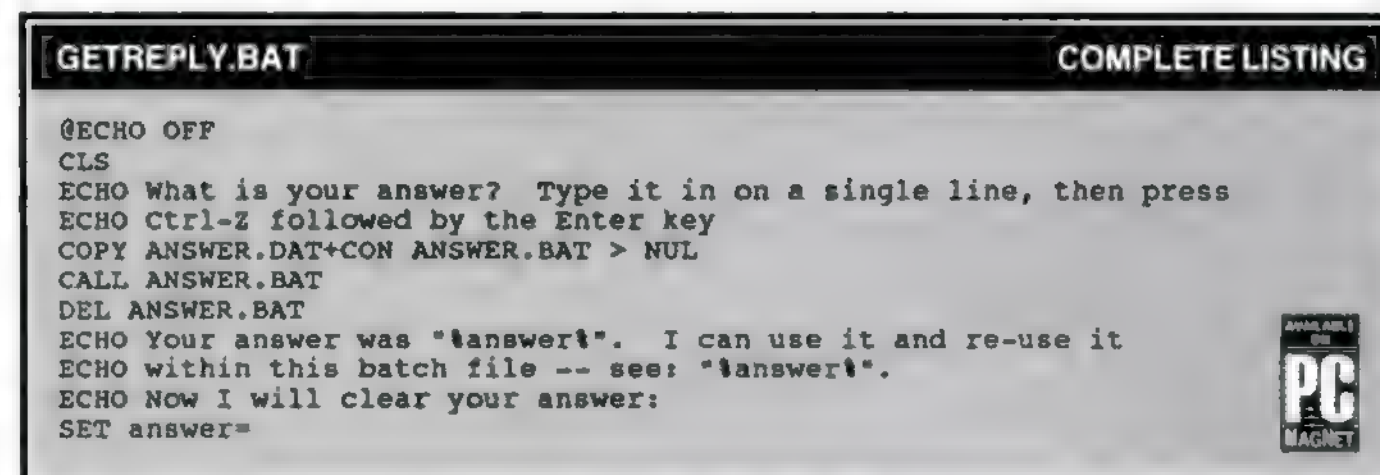


Figure 9: The technique in GETREPLY.BAT is somewhat risky, but it accepts whole words and phrases as user input.

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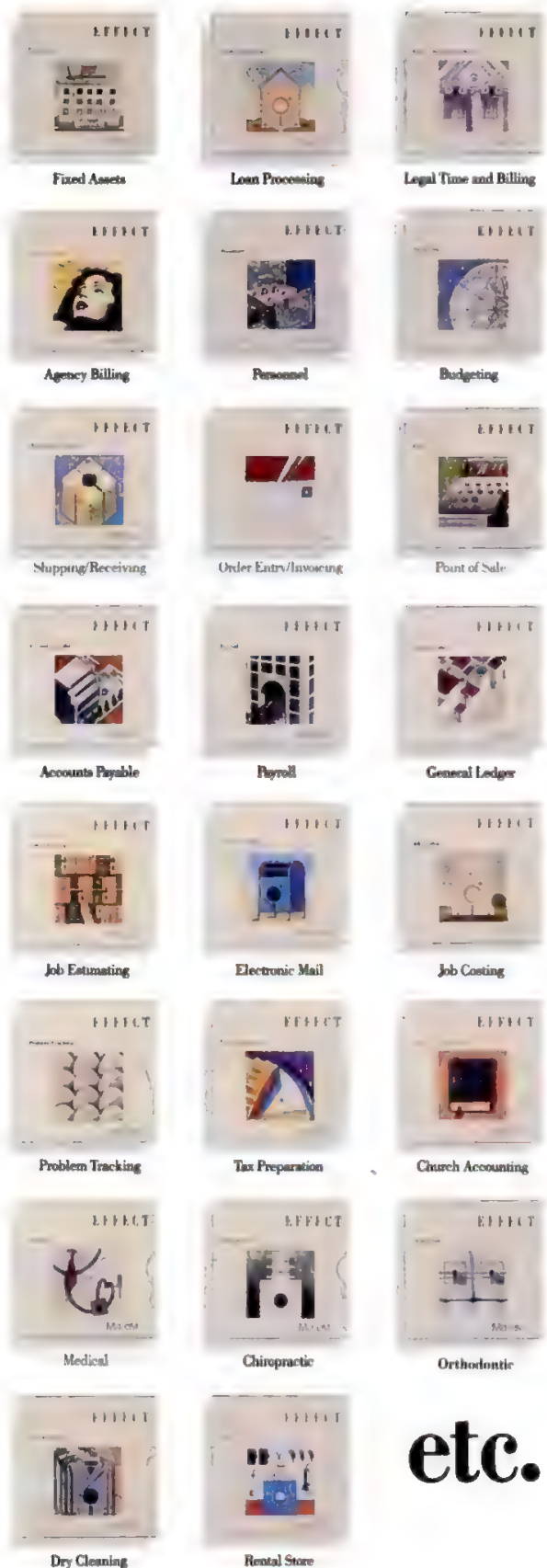
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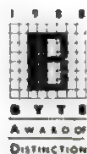
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Lab Notes

space, you can use the REMFREE.BAT program shown in Figure 10 to make a REM-free copy of any batch program. It renames the original to *.REM, leaving your REM comments intact, but then goes on to strip out any line that contains the word REM followed by a space. Since there's a faint chance it might remove a line such as

```
ECHO This batch file removes
REM statements
```

you might want to get a preview of the lines REMFREE will remove. To do so, enter the command

```
FIND "REM " filename.BAT | MORE
```

You can also speed up your batch programs by careful placement of labels. Put your most used labels closest to the top of the program so that DOS won't have to look far for them. Again, many batch files have an :End label at the end, and GOTO End lines scattered throughout. Replace those GOTO End lines with a call to the 1-byte batch file QUIT.BAT discussed earlier in connection with QF.BAT. With QUIT.BAT on your PATH, a line like

```
IF NOT EXIST %1 QUIT
```

will end your program quickly.

SWATTING BUGS

It's quite difficult to debug batch programs. Some programming languages return helpful error messages, such as "Out of range error at offset 1234," but a buggy batch program may give you nothing more than "Syntax error" or "Bad command or filename." Or it may just plain quit.

If the batch file is small, you can track what it's doing by removing the "ECHO OFF" at the top. Keep your finger poised on Ctrl-S to stop the information on the screen from whizzing by too fast. With a larger program, your next recourse should be to insert ECHO statements such as "Reached label START" and "About to print file DATA". With enough of these, you can usually pinpoint the problem area and, with luck, eliminate the bug.

If you go to this much trouble to make a batch program debuggable, you may not want to delete all of your debugging aids

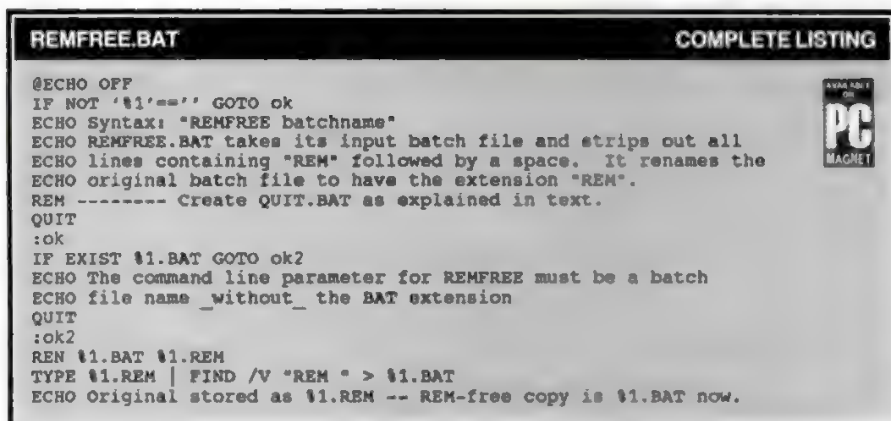


Figure 10: REMFREE makes a copy of any batch file with all the REM statements stripped out.



Figure 11: BATSONG uses BATCHMAN's special effects to produce an animated rendition of the "Batman" theme song. To save 5 bytes of space per line, set BATCHMAN equal to e-var b.

Lab Notes

after you've fixed the problem. You don't have to. To keep them in place for future use, just precede them with

```
IF "DEBUG"=="Y" THEN
```

Now when you modify the batch program and need to debug it again, you need only

```
SET DEBUG=Y
```

before running it.

Above all, *comment* your programs thoroughly. It's true that REM statements slow down batch processing, since DOS has to look at each of them to find the next executable line. But it's usually well worth this minor slowdown if, in exchange, you will be able to read and thoroughly understand your batch programs. If you can spare the disk space, use REMFREE.BAT to create a second working copy of your batch program with REM statements eliminated.

BATCH OUTPUT WITH BATCHMAN

BATSONG.BAT, listed in Figure 11 and shown in Figure 12, uses most of **BATCHMAN's** "special effects" to play and animate the "Batman" theme song. Since almost every line of the program calls **BATCHMAN**, the first line sets the **e-var b** to the value **BATCHMAN**. The rest of the program then uses **%b%** instead of writing out **BATCHMAN** each time, thus saving 5 bytes per line.

To set up for the show, the first few

EGAHELP.BAT

COMPLETE LISTING

```

@ECHO OFF
BATCHMAN ansi
IF NOT ERRORLEVEL 1 GOTO gotansi
BATCHMAN CECHO C @Dh,ExcuuuuUUuuuuse me
BATCHMAN BEEP 40,1;40,1;40,1;40,1;40,1;40,1;40,1
BATCHMAN CECHO @Ph,, but this batch file needs to have ANSI loaded.
REM ----- Create QUIT.BAT as explained in text.
QUIT
:gotansi
BATCHMAN display
IF ERRORLEVEL 9 GOTO notEGA
IF ERRORLEVEL 4 GOTO EGA
:notEGA
BATCHMAN CECHO C 2@6,ExcuuuuUUuuuuse me
BATCHMAN BEEP 40,1;40,1;40,1;40,1;40,1;40,1;40,1
BATCHMAN CECHO 15,, but this batch file needs an EGA or VGA!
QUIT
:EGA
BATCHMAN E43V50
BATCHMAN CLS 3ch
CLS
BATCHMAN WINDOW 32,14,52,7,4eh,-
BATCHMAN SETCURSOR 33,17
BATCHMAN CECHO 4Ph,Key                                Command
BATCHMAN SETCURSOR 34,17
BATCHMAN CECHO 4eh,D for an ordinary directory        DIR
BATCHMAN SETCURSOR 35,17
BATCHMAN CECHO 4eh,W for a Wide directory             DIR /W
BATCHMAN SETCURSOR 36,17
BATCHMAN CECHO 4eh,Q to Quit this help
BATCHMAN SETCURSOR 37,17
BATCHMAN CECHO 4eh,Press Alt AFTER Q to keep this help onscreen
BATCHMAN SETCURSOR 3,1
:loop
  BATCHMAN GETKEY 'DWQ'
  FOR %%v IN (1 2 3) DO IF ERRORLEVEL %%v GOTO choice%%v
:choice1
  DIR
  GOTO loop
:choice2
  DIR /W
  GOTO loop
:choice3
BATCHMAN BEEP 2000,1
BATCHMAN SHIFT ALT
IF NOT ERRORLEVEL 1 MODE C080

```

Figure 13: This uses BATCHMAN to create a split-screen DOS help menu for 43-line EGA or 50-line VGA displays.

lines of BATSONG clear the screen with a blue background and hide the cursor. BATCHMAN's CURSORTYPE command is used to control the size of the cur-

son; setting its parameters to values of 32,0 renders the cursor invisible on most systems. The fancy border comes from five BATCHMAN WINDOW commands, with the final frameless window clearing the area inside the border. Each line of the song uses CECHO to echo text to the screen in color, and the BEEP function provides the music. To be perfectly honest, it's not easy to write a song using BEEP, but BATSONG proves that it is possible. BATCHMAN's own documentation lists the BEEP numbers for each note, but I cheated a little by using my own PIANOMAN program to create the tune. I then translated it into a form that BATCHMAN could digest.

The animated "POW!" box at the end of BATSONG extends BATCHMAN's special effects to the limit. To get ready for the main loop, BATSONG initializes the e-vars pl (for PLace) and op (for Old Place). SETLOOP 7 prepares for repeating a series of lines seven times. The lines

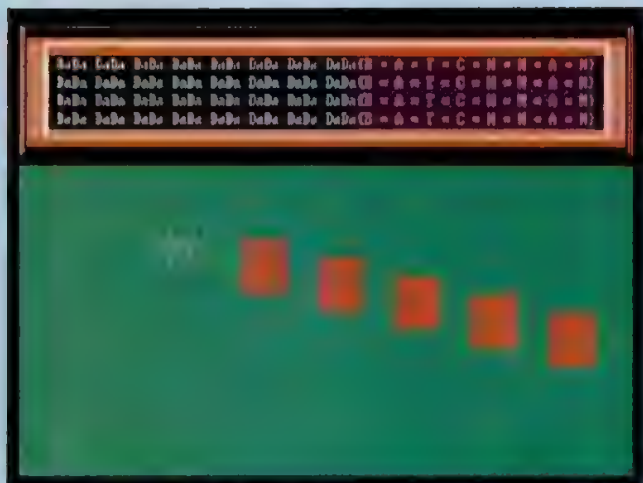
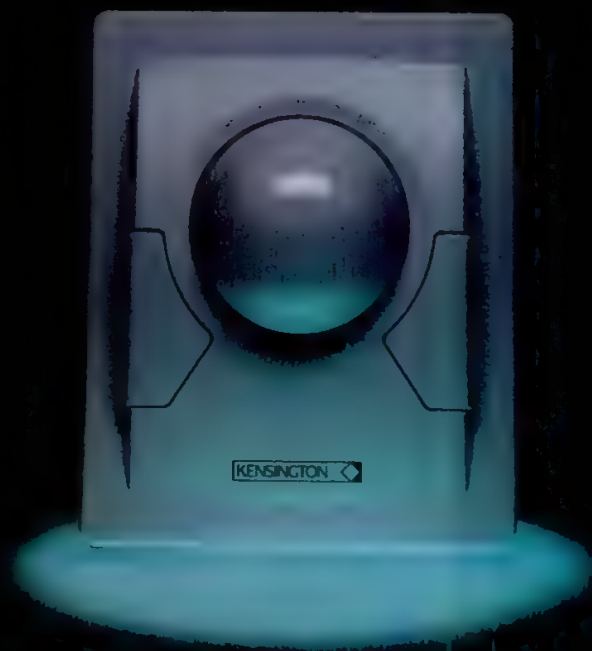
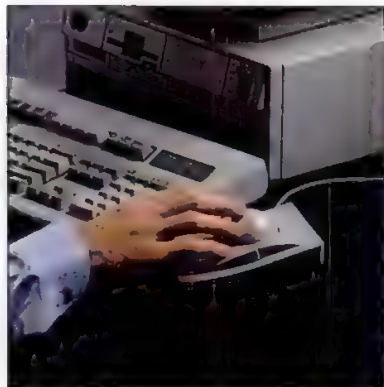


Figure 12:
Running
BATSONG.BAT
produces a colorful
display with fancy
borders.

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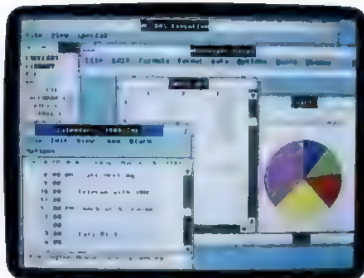
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Lab Notes

within the loop write the "POW!" box, make a noise, and then erase the box. The two e-vars control the box's position, and they change with each pass through the loop. (That's what makes the box move.) Note that with the blue background set up at the beginning of the program, erasing the "POW!" box leaves a trail of red boxes behind, as shown in Figure 12. For a different look, you can change the background to red. The boxes will then show a different border and will be erased completely. With a little experimentation you can create many different effects.

You'll note that the "POW!" box proceeds rather sedately across the screen. It will move more quickly—but not *much* more quickly—if you put both BATSONG and BATCHMAN on a RAMdisk. Batch programs are not famous for their speed. Make sure BATCHMAN is in the same directory as BATSONG.BAT, however—if DOS has to search the path to find it, the entire song will become a dirge. Try it and hear the difference.

The EGAHELP.BAT program listed in Figure 13 calls upon BATCHMAN's fa-

cilities to create a DOS help system on a 43-line EGA or 50-line VGA screen. It starts by checking that the display is at least EGA and that ANSI.SYS is loaded. Then it paints a simple help menu in the bottom half of the screen. The user can choose from the list of commands by pressing a key, with the GETKEY function handling the keyboard input. Pressing Q quits the help system (again, using QUIT.BAT), and holding down the Alt key immediately after pressing Q leaves the help screen visible. BATCHMAN's SHIFT ALT function detects the Alt key, which returns an EL of 1 when the Alt key is held down.

BATCHMAN SEES ALL, KNOWS ALL

The INFO.BAT program (Figure 3) mentioned earlier exercises BATCHMAN's system-information-gathering functions. It reports on memory, CPU type, drives, and video display. Since BATCHMAN returns much of this data in the EL, INFO uses the techniques described above to analyze the EL and display an appropriate message. If the output is simple—for example, when the rows and columns are displayed—INFO uses BATCHMAN's /R switch to make its report. It runs the auxiliary batch file DRIVINFO.BAT (Figure 5) using a FOR loop to check each

possible drive letter from A: to Z:; DRIVINFO prints the letter only if that drive exists as a physical or SUBSTed drive.

After presenting its system information, INFO.BAT uses a flashing "Press any key" box to demonstrate how you can create rather fancy output with the BATCHMAN utility. The SETLOOP 10 and DECLOOP commands surround a

With techniques like
the FOR loop,
one BATCHMAN
program—INFO.BAT—
incorporates several
smaller programs
and returns a
comprehensive status
report on your system.

```
FRIDAY13.BAT                                     COMPLETE LISTING
@ECHO OFF
BATCHMAN WEEKDAY
REM ----- Is it a Friday?
IF ERRORLEVEL 5 IF NOT ERRORLEVEL 6 GOTO Friday
GOTO normal
:Friday
BATCHMAN DAY
REM ----- It's Friday, but is it the 13th?
IF ERRORLEVEL 13 IF NOT ERRORLEVEL 14 GOTO Thirteen
GOTO normal
:Thirteen
BATCHMAN CECHO C 4fh, BE CAREFUL TODAY! It's . . .
BATCHMAN CECHO C0h, FRIDAY THE THIRTEENTH!
BATCHMAN BEEP 440,10;494,3;523,7;440,7;10,7;440,10;494,3;523,7;440,7;622,36
:normal
ECHO Now carrying out normal business
```

Figure 14: Although this batch file will warn you on any Friday the 13th, the BATCHMAN commands it embodies can be put to more-practical uses via your AUTOEXEC.BAT.

```
COPYIF.BAT                                     COMPLETE LISTING
@ECHO OFF
BATCHMAN CANCOPY %1 %2
IF NOT ERRORLEVEL 1 GOTO ok
REM ----- "G" in next line is Ctrl-G -- hold Ctrl, type G.
ECHO Sorry, not enough room on %1 to copy %2
REM ----- Create QUIT.BAT as explained in text.
QUIT
:ok
COPY %1 %2
```

Figure 15: COPYIF.BAT copies a set of files to a floppy disk or warns you if there isn't enough room. After the warning, the program pauses, allowing you to change the disk or the file specification.

main loop that will run at most ten times. Within the loop INFO.BAT writes "Press any key" in a cyan-on-red box, then beeps and waits 1 second. If the user presses a key, it quits. It repeats the process with a red-on-cyan box, then loops back. The effect is a flashing box that remains on your screen for a little over 20 seconds, or until the user presses a key.

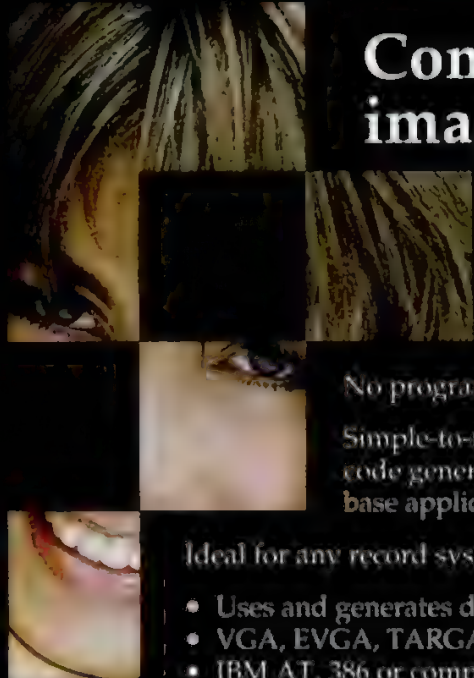
BATCHMAN's date and time tests make it possible to set up batch files with sections that operate only on certain days of the week, days of the month, or at certain times. FRIDAY13.BAT (Figure 14) uses this feature to execute certain lines only on Friday the 13th. To see it in action, use the DATE command to set your system date to October 13, 1989, then run FRIDAY13.BAT. (Be sure to restore the system date afterward!) For more practical uses, you might enhance your AUTOEXEC to perform a weekly backup every Friday, or to run a set of diagnostics on the first of every month.

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contains the bonus utilities QFORMAT, CANCOPY, RENDIR, and TYPEMATIC. RENDIR and TYPEMATIC need no more explanation than is provided in the BATCHMAN article, but QFORMAT and CANCOPY work best when wrapped in tiny batch programs.

QF.BAT, shown in Figure 2, is the batch file I use to quick-format a stack of old floppies. Its main loop keeps quick-formatting diskettes one after another: you simply tap the Spacebar when another disk is ready, or press Q to Quit. If QFORMAT fails on any of the diskettes, QF.BAT will give you a warning. Don't throw away those diskettes, though—they may simply be the wrong type for the drive you're using, or they may have never been formatted with DOS's FORMAT command. If you're quick-reformatting diskettes in your 360K drive, therefore, you should save those diskettes that fail and try them in a 1.2MB disk drive.

COPYIF.BAT in Figure 15 uses the BATCHMAN CANCOPY command to help you intelligently back up files from your hard disk onto a floppy disk. The command

`COPYIF filespec d:`

will simply copy all the matching files to the specified drive if there's room for them. If there is not enough space, it will notify you and halt, so you can choose a different set of files or a floppy disk with more available space.

VIVE LA BATCH!

Strictly speaking, batch programming is superfluous. If you want the computer to perform five specific actions, you can enter one command, wait for it to finish, enter the next, wait for it, and so on. But if you have more to do with your life than baby-sit a computer, BATCHMAN and the DOS batch processor will handle your list of commands and give you some programming power as well. Perhaps in the future we'll instruct our computers with brain waves or by gazing deeply into icons. But as long as the DOS command line endures, so will batch programming. The least we can do is do it right. ■

Neil J. Rubenking is a contributing editor of PC Magazine.



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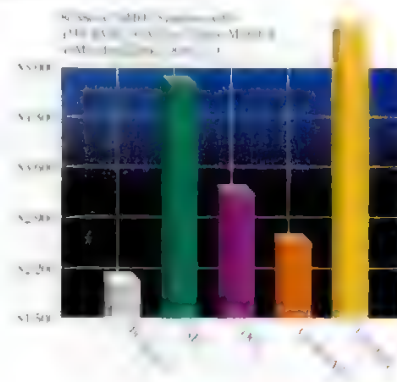
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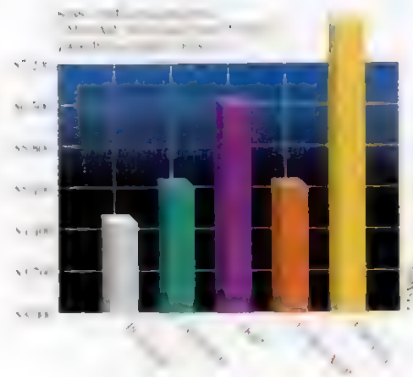
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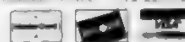
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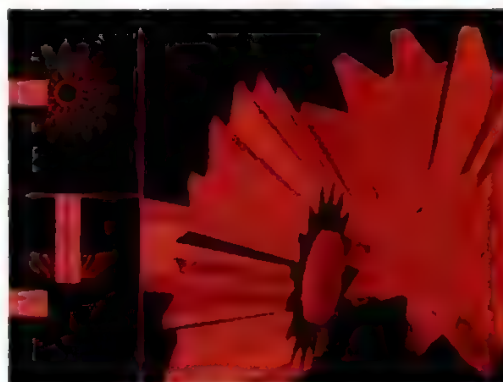
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by
Michael J. Mefford

Utilities

Everyone loves what batch files do, but nobody likes to write them. If you've ever tried to go beyond creating a simple AUTOEXEC.BAT file, the limitations of the batch file language and its internal DOS commands quickly become apparent.

If you change the current directory in a batch file, for example, restoring it at the end is awkward at best. You can't control the display color when you invoke the ECHO or CLS commands. And that the batch file command

```
IF string1==string2
```

is case sensitive means you have to write a whole series of compares to handle mixed-case strings.

This issue's utility, BATCHMAN, is designed both to give your batch files significantly more power and to add many of the refinements we all wish DOS provided. You can check the DOS version, available memory, or display type and then branch accordingly. You can create colorful menus that branch on a user keypress. And, among its many other capabilities, BATCHMAN will let you adjust the keyboard typematic rate and tame the grating DOS beep or turn it into a tune.

BATCHMAN is actually a collection of 48 batch file enhancement utilities, all rolled into one 6K program. This provides more than convenience: if BATCHMAN's utilities were stored separately, at a minimum of one cluster each, they'd take up about 100K of disk space.

Because of the large number of utilities included in BATCHMAN, however, there won't be space here to present our usual discussion of the programming techniques used in the program itself. Nor is it possible to encapsulate all 48 different BATCHMAN commands in a separate DOS-manual lookalike page.

You can get a ready-to-run copy of BATCHMAN by downloading it from PC MagNet, as explained in the sidebar "BATCHMAN by Modem." Because of space limits, we cannot print the source

Add Music, Color, and Power to Your Batch Files with BATCHMAN

■ If you've chafed at the limitations of DOS's batch file language, here's how you can refine your batch files and make them more powerful and flexible.

code here, but if you're interested in examining it, download BATCHMAN.ASM as well. To get the assembly or BASIC listings by mail or fax, send a written request with your name, address, and fax number (if applicable) to *PC Magazine*, Utilities, One Park Ave., New York, NY 10016; Attention: Carolyn Falconer. No phone calls please. (Note: estimated fax length is 30 pages.)

PC MagNet is also the best place to contact me if you have questions or would like insights into the workings of the program. (And perhaps our technical editor will feel the urge to publish our discussions in a later issue.)

ERRORLEVEL CODE

The key to BATCHMAN's operations is the ERRORLEVEL code, a number that programs can report to DOS when they terminate and that can be acted upon from a batch file. "ERRORLEVEL" is a poorly chosen name, for although it *can* indicate that something went wrong with the program, the ERRORLEVEL code really has many more uses. The term "MESSAGE-NUMBER" would have been a better

name, for the ERRORLEVEL is simply a means by which a program can communicate with the DOS batch processor. DOS's designers stuck us with ERRORLEVEL, however, which I'll abbreviate as EL for the rest of this article.

An EL can have a value between 0 and 255. Each BATCHMAN command returns information as an EL. An explanation of the syntax of each of the BATCHMAN commands and the ELs they return will be found below. For examples of how to use the BATCHMAN ELs within batch files, see Neil J. Rubenking's Lab Notes, "Sharpening Your DOS Batch File Programming Skills," in this issue.

The syntax for BATCHMAN is

```
BATCHMAN [command] [arguments] [/R]
```

Entering BATCHMAN without any pa-

CORRECTION

The 1STCLASS utility in the November 14, 1989, issue of *PC Magazine* has caused some confusion with the *1st-CLASS Software* product produced by 1st-CLASS Expert Systems Inc. of One Longfellow Center, 526 Boston Post Rd., 150 East, Wayland, MA 01778. We apologize for the unintentional confusion, and to make sure that further confusion does not arise, we have changed its name. 1STCLASS is now called EMMA (Electronic MCI Mail Agent), and its COM port driver, COURIERS, is now BESS (Better Serial Services).

Utilities

parameters (or with an invalid parameter) will bring up a multiscreen display that lists all the BATCHMAN commands. The optional *arguments* are parameters for any given *command*. If you add the optional /R switch, BATCHMAN will display the EL returned from the command. This Report option will be most helpful when you are designing and debugging your batch files. Be sure to place BATCHMAN in a directory included on the DOS PATH so that your batch files can find it.

THE BATCHMAN COMMANDS

I will be using the following conventions throughout the article: the commands will be listed first, followed by any parameters they might accept, followed by the EL the command will return. I'll put the EL in curly brackets so no one will think it's part of the command syntax and try to type it in. For example,

```
CLS [nn] (EL=8)
```

If it is entered without the optional *nn* color

argument, the command

```
BATCHMAN CLS
```

will clear the screen with whatever color it finds at the current cursor position. This provides the most flexibility when you plan to distribute a BATCHMAN batch file to other systems, because it retains the user's custom color scheme.

If you wish to control the CLS color, just add the color argument *nn*, where *nn* is a decimal or hexadecimal value derived from the table in Figure 1. Hexadecimal numbers need a suffix of "h" to distinguish them from decimal. Selecting a color in hex is easier than in decimal because each of the 16 possible values for each of the background and foreground colors fits into a single digit: the first digit is background, the second foreground.

To clear the screen so that subsequent DOS output will use blue letters on a light gray background, for example, you would enter

```
BATCHMAN CLS 71h
```

The first number (7) is the background color, and the second (1) is the foreground

color. To do the same using a decimal number requires a little math: the background color is multiplied by 16 and added to the foreground. In the above example, the decimal equivalent would be $(7 \times 16) + 1 = 113$, so the equivalent command in decimal would be

```
BATCHMAN CLS 113
```

Like its DOS counterpart, BATCHMAN's CLS homes the cursor to the top-left corner. Unlike the DOS CLS, however, BATCHMAN's will clear the whole screen properly in video modes such as the 43-line EGA and 50-line VGA modes.

```
CECHO [C] [nn,]string (EL=8)
```

CECHO is similar to the DOS ECHO command except you can choose the color of the echoed string. The *nn* color value is entered in the same manner as with CLS, and again, if you don't enter a color value, BATCHMAN will use the currently specified color. To echo a "Zowie!" to the display in an eye-catching blinking yellow on red, you would enter

```
BATCHMAN CECHO CEh,Zowie!
```

The hex value C, for the background color, normally displays as orange for a foreground color. When used as a background color, however, it displays as the blinking low-intensity counterpart, red. Keep in mind that any high-intensity color selected for the background will blink in its corresponding low-intensity color value.

The optional C parameter that is shown in CECHO syntax (don't confuse it with the hex C color value in the immediately preceding example) stands for "no carriage returns." Normally, both CECHO and the DOS ECHO move to the next line after echoing a string. At times this is not desirable. For example, you might wish to echo two strings with different colors on the same line. With BATCHMAN you can suppress the carriage return by adding a solitary C as the first argument. For example, to display a red on yellow blinking "Zowie!" followed by a normal red on yellow "Batchman!" on the same line, your batch file would consist of

```
ECHO OFF
```

```
BATCHMAN CECHO C CEh,Zowie!
```

```
BATCHMAN CECHO 4Eh,Batchman!
```

You can suppress the carriage return to

BATCHMAN BY MODEM

The programs published in *PC Magazine* are available by modem from PC MagNet.

To join PC MagNet, set your communications software for either 300 or 1,200 bits per second, 7 data bits, even parity, 1 stop bit, and full duplex. To find the telephone number nearest your dialing exchange, dial (800) 346-3247. When the modem makes a connection, press Enter. At the prompt designated HOST NAME, enter PHONES. Follow the menus and make a note of the number closest to you.

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States, call (614) 457-8650.

To download BATCHMAN.COM and its assembly or BASIC listings, log on to PC MagNet. Enter GO UTILITIES or choose PC MAGAZINE UTILITIES from the top menu, then DIRECT UTILITY DOWNLOAD from the next menu. Enter the filename, then select the file you want to download from those presented. Answer yes (Y) to DO YOU WISH TO DOWNLOAD? Press Enter to see the transfer protocols. Choose a protocol and download the file.

You don't have to be a member of CompuServe to access PC MagNet. It costs \$12.80 per hour for 1,200/2,400-bps service and \$6.30 for 300 bps, via MasterCard, VISA, or American Express. These programs can be copied but are copyrighted and are made available only for noncommercial use. You may make copies for others as long as no charge is involved, but making copies for any commercial purpose is prohibited. ■

Utilities

prevent the display from scrolling when you echo to the last line of the display. This feature makes full-screen menus feasible, whereas echoing to the last line with DOS ECHO causes the screen to scroll, spoiling any previous display layout.

```
SETLOOP [n] {EL=0}
.
.
DECLOOP {EL=SETLOOP-1}
```

You use SETLOOP and DECLOOP when you want to repeat a set of batch file commands. SETLOOP sets a loop counter to the *n* argument, which can be a decimal number between 0 and 255. Once the counter is set, the BATCHMAN DECLOOP command will decrement the counter each time it is executed and return the new value of the loop counter as an EL. The short batch file

```
ECHO OFF
BATCHMAN SETLOOP 10
{HERE
BATCHMAN CECHO ZONK!
BATCHMAN DECLOOP
IF ERRORLEVEL 1 GOTO HERE
```

will echo "ZONK!" to the display ten times before terminating. The batch processor will branch to the HERE label as long as the EL is 1 or greater.

Programmers may wonder where the loop counter is stored while other commands are executing. For the SETLOOP and PUSHPATH commands (PUSHPATH/POPPATH will be discussed below) BATCHMAN creates a small TSR of approximately 500 bytes. The loop counter uses 1 byte for its storage; the balance is reserved for path strings. When the loop counter becomes zero, the BATCHMAN TSR data area is returned to the system memory pool (unless PUSHPATH is also using the data area). Note that since the loop counter is only 1 byte, you cannot do loop nesting.

If you exit a batch file before SETLOOP has decremented to zero, the TSR data area will not be released. You should construct your batch files so that any early exit from a loop will execute a SETLOOP 0 to force a recovery of the TSR data area. BATCHMAN is smart enough not only to find its previous TSR data, but also to pre-

vent the creation of another if you try to enter two SETLOOP commands.

```
QFORMAT [d:] [N]
{EL=0 if successful; EL=1 if not.}
```

QFORMAT will wipe out all the files and subdirectories on a floppy disk at a single stroke. To keep you from trashing your hard disk, the command accepts only A: or B: as drive arguments. All other drive requests are ignored, and you don't have to list the drive if A: or B: is the current default drive.

Further, QFORMAT warns you that all data will be lost. To confirm, you must press Y and Enter. Any other keypress aborts the process. If you don't want BATCHMAN to pause and ask for your

approval, you can add the optional N argument to the command. The N stands for "no ask." Use this option with caution!

QFORMAT will work only on diskettes that have already been formatted by DOS. The DOS FORMAT command puts vital information about the media type, number of clusters per FAT, and so forth in the boot sector of the disk. BATCHMAN's QFORMAT command uses this information to find and place zeros in the FAT and root directory sectors of the disk.

The reason QFORMAT can be so fast is that it doesn't have to do the same work as the DOS FORMAT command. FORMAT not only does a low-level format, but it also writes over the entire data area of the disk. It's the low-level- and data-format process that takes forever. A low-level for-



BATCHMAN COLOR VALUES

BATCHMAN 1.0 (C) 1989 Ziff Communications Co. • PC magazine • Michael J. Mefford



Low-intensity colors			High-intensity colors		
	Hex	Decimal		Hex	Decimal
Black	0	0	Dark gray	8	8
Blue	1	1	Light blue	9	9
Green	2	2	Light green	A	10
Cyan	3	3	Light cyan	B	11
Red	4	4	Orange	C	12
Magenta	5	5	Violet	D	13
Brown	6	6	Yellow	E	14
Light gray	7	7	White	F	15

Figure 1: Select a background and foreground color value for CLS or CECHO from the table. Blue on light gray is 71h in hex, and its decimal equivalent is $(7 \cdot 16) + 1 = 113$. Note: a high-intensity color for the background results in blinking characters of the corresponding low-intensity color.

Utilities

mat needs to be done only once, and QFORMAT blithely skips that step. QFORMAT is sophisticated enough, however, to preserve bad-sector information.

```
PUSHPATH
(EL=0 if successful; EL=1 if not)

POPPATH
(EL=0 if successful; EL=1 if not)
```

PUSHPATH saves the current drive and directory, which can later be restored with POPPATH. Typically, a batch file that executes an application includes a DOS CD command (often a change of drive as well) to move operations to the place where the application resides. After the application terminates, it's usually desirable to return to the original path.

By way of example, to run *Lotus 1-2-3* on drive D: and then return to the default path afterwards, your batch file would look something like this:

```
BATCHMAN PUSHPATH
D:
CD \123
123
BATCHMAN POPPATH
```

PUSHPATH saves the current path in a TSR data area, just as the SETLOOP command does. While only 1 byte is reserved for SETLOOP's loop counter, BATCHMAN's TSR data area allows stacking up several paths with PUSHPATH. Subsequent POPPATH commands will retrieve the paths on a LIFO (Last In First Out) stack basis.

Suppose, for instance, that you're currently in your directory and you issue the following commands:

```
BATCHMAN PUSHPATH
CD \DOS
BATCHMAN PUSHPATH
CD \PCMag
BATCHMAN POPPATH
BATCHMAN POPPATH
```

In this sequence, the first POPPATH puts you back into the \DOS subdirectory, and the last POPPATH restores you to the root directory from which you started.

The number of path layers that can be

stored will vary with the length of each path pushed onto the stack. BATCHMAN's TSR area reserves 408 bytes for paths, which allows for six levels of nested paths if each path is the maximum 65 characters allowed by DOS. Shorter pathnames will allow nesting more than six levels. If necessary, you can change the storage size by modifying the DIR_COUNT equate in the assembly listing.

BATCHMAN returns an EL of 1 if it finds the stack too full for another PUSHPATH or if the stack is already empty with a POPPATH. Otherwise, the EL returned is 0. When the last path is popped off the stack, the TSR data area is discarded and returned to the DOS memory pool.

```
ANSI (EL=0 if ANSI found;
      EL=1 if not found)
```

This BATCHMAN command is designed to determine simply whether ANSI.SYS is or is not installed. If the EL is 1, you can then branch around any ANSI.SYS escape sequences contained in your batch files. BATCHMAN is smart enough to detect not only ANSI.SYS, but my own ANSI.COM alternative (see the January 31, 1989, Utilities column), but it will not find other ANSI.SYS emulators, such as *DESQview*'s DV-ANSI.

```
BEEP [m,n[;m,n]...] (EL=0)
```

The BATCHMAN BEEP command gives

you a lot of flexibility in controlling the frequency and length of the sound DOS emits in response to a Ctrl-G character. The *m,n* beep arguments are decimal numbers used in pairs and separated by a comma. The *m* value is the frequency in hertz, and *n* is the number of 1/18th-second increments that make up the duration.

The frequencies of various musical notes can be found in the table in Figure 2. The command for a middle-C beep of a half second, for example, would be

```
BATCHMAN BEEP 262,9
```

By separating the argument pairs with semicolons, you can produce a series of tones with the same BEEP command. You might, for example, want to try

```
BATCHMAN BEEP 392,3;523,3;659,3;
784,3;10,3;659,3;784,12
```

The lowest valid frequency is 19, a very low buzzing sound. You can use a value less than 19 to create pauses between tones: no sound will be emitted, but the duration argument is executed, effectively producing a programmable delay between notes. For an example of how far you can go with this, see the batch file Neil Rubenking provides to play the "Batman" theme song in this issue's Lab Notes.

If you omit all arguments, BEEP defaults to 1046,1—a C note lasting 1/18th of a second. The DOS Ctrl-G beep is a fre-

MUSICAL NOTE FREQUENCIES								
Note	Frequency (Hz)							
A	55	110	220	440	880	1760	3520	
A*,B ^b	58	117	223	446	932	1857	3714	
B	62	123	247	494	988	1976	3952	
C	65	131	262	523	1046	2093	4186	
C*,D ^b	69	139	277	554	1109	2217	4434	
D	74	149	294	587	1175	2349		
D*,E ^b	78	156	311	622	1245	2489		
E	82	165	330	659	1319	2637		
F	87	175	349	698	1397	2794		
F*,G ^b	93	185	370	740	1480	2960		
G	98	196	392	784	1568	3136		
G*,A ^b	104	208	415	831	1661	3322		

Figure 2: You can use the BATCHMAN BEEP command to create tones—and even tunes. Any of the values above can be substituted for *m* to achieve the desired frequency. Middle C has a frequency of 262 Hz. The default DOS BEEP is two octaves above middle C, at 1,046 Hz.

Utilities

quency of 886 that lasts for 1 second. Musically, a frequency of 886 is an out-of-tune A, which probably explains why it grates on so many ears.

```
WAITTIL hh:mm[:ss]
{EL=0 if successful; EL=1 if aborted}
```

WAITTIL provides a convenient way to pause until a certain time of day. The *hh:mm[:ss]* argument is the time in hours, minutes, and (optionally) seconds. BATCHMAN will wait until the specified time arrives, but you can manually abort the wait by entering any keystroke. A typical application for WAITTIL would be to execute an electronic bulletin board communications program that would automatically download messages late at night when rates are lower.

```
WAITFOR [mm:]ss
{EL=0 if successful; EL=1 if aborted}
```

WAITFOR simply pauses for a specified number of minutes (*mm*) and seconds (*ss*). You can omit the minute part of the argument if you desire. As with WAITTIL, the WAITFOR delay can be overridden by pressing a key.

```
CURSORTYPE [m,n]
```

You can use CURSOR TYPE either to create a cursor size that suits your taste or to restore the normal underline cursor after an application alters it. Entering CURSOR TYPE without any arguments will default to the standard underline cursor. To create a custom cursor, you supply the *m,n* arguments as the start- and stop-line values. These values can be either decimal or hex; for hex input, add the "h" suffix to the number.

The top of the character box is logical line zero; successively numbered lines increment downward. The valid scan-line values used for *m* and *n* are 0 to 7 for a CGA, 0 to 13 for a monochrome or EGA, and 0 to 15 for a VGA. The default underline cursor start/stop lines are 6,7 for a CGA, 11,12 for a monochrome or EGA, and 13,14 for a VGA. To set an EGA solid block cursor, for example, you should enter the following:

```
BATCHMAN CURSOR TYPE 0,13
```

Note that the EGA BIOS on some video boards will attempt to override your selections. To avoid this mishap BATCHMAN temporarily turns off this BIOS EGA emulation logic for all video boards when the cursor type is set, and this seems to work for most systems. However, if entering CURSOR TYPE without arguments does not give you the normal default underline cursor, you can explicitly request an underline cursor that fits your display. You may find that you need to do this for video modes other than the normal 25-line modes. A "wraparound" cursor, in which the stop line has a lesser value than the start line, is supported by the hardware of only some video systems.

```
BREAK {EL=0 if off; EL=1 if on}
```

The BATCHMAN BREAK command returns the current state of DOS's Ctrl-Break checking. You can change the state of BREAK with the DOS command of the same name.

```
DRIVEEXIST d:
{EL=1 if exist; EL=0 if not}

DIREXIST directory
{EL=1 if exist; EL=0 if not}
```

These two BATCHMAN commands are used to return an EL of 1 to your batch files if the specified variable exists and an EL of 0 if it does not.

```
DEVOL [d:]volume
{EL=1 if exist; EL=0 if not}
```

Similarly, this command returns an EL of 1 if a particular disk volume exists on the named drive.

```
YEAR {EL=year from 1980
      {0-199}, where 0=1980}
MONTH {EL={1-12}}
DAY {EL={1-31}}
WEEKDAY {EL={0-6}, where
          Sun=0; Sat=6}
HOUR {EL={0-23}}
MINUTE {EL={0-59}}
SECOND {EL={0-59}}
```

This group of BATCHMAN commands returns the system time and date. Note that you can obtain a relatively fine resolution of the time.

```
VIDEOMODE {EL={0-19}}
```

The ERRORLEVEL that is returned by

PC VIDEO DISPLAY MODES	
EL	Display mode
0	40 x 25 black and white
1	40 x 25 color
2	80 x 25 black and white
3	80 x 25 color
4	320 x 200 color
5	320 x 200 black and white
6	640 x 200 black and white
7	Monochrome
13	320 x 200 color EGA
14	640 x 200 color EGA
15	640 x 350 monochrome EGA
16	640 x 350 color EGA
17	640 x 480 color VGA
18	640 x 480 color VGA
19	320 x 200 color VGA

Figure 3: The BATCHMAN VIDEOMODE command uses the ERRORLEVEL code to indicate the current mode of the video display.

the VIDEOMODE command allows you to determine which of the possible screen modes listed in Figure 3 is currently being used by your display.

```
ROWS {EL=display rows}
COLS {EL=display columns}
```

These obvious but very handy commands return the current number of rows or columns displayed.

```
SETCURSOR m,n {EL=0}
```

By supplying values for *m* (the row) and *n* (the column), you can use SETCURSOR to place your cursor at the specified screen location. By using SETCURSOR in concert with CECHO, you can precisely control the location of your messages. For example, to display "Gotham City" in blue in the middle of the screen, you would create the following batch file:

```
ECHO OFF
BATCHMAN SETCURSOR 12,35
BATCHMAN CECHO 1,Gotham City
```

Be sure to include the ECHO OFF command, so that DOS won't spoil your display by echoing the commands. ECHO OFF will also ensure that the cursor

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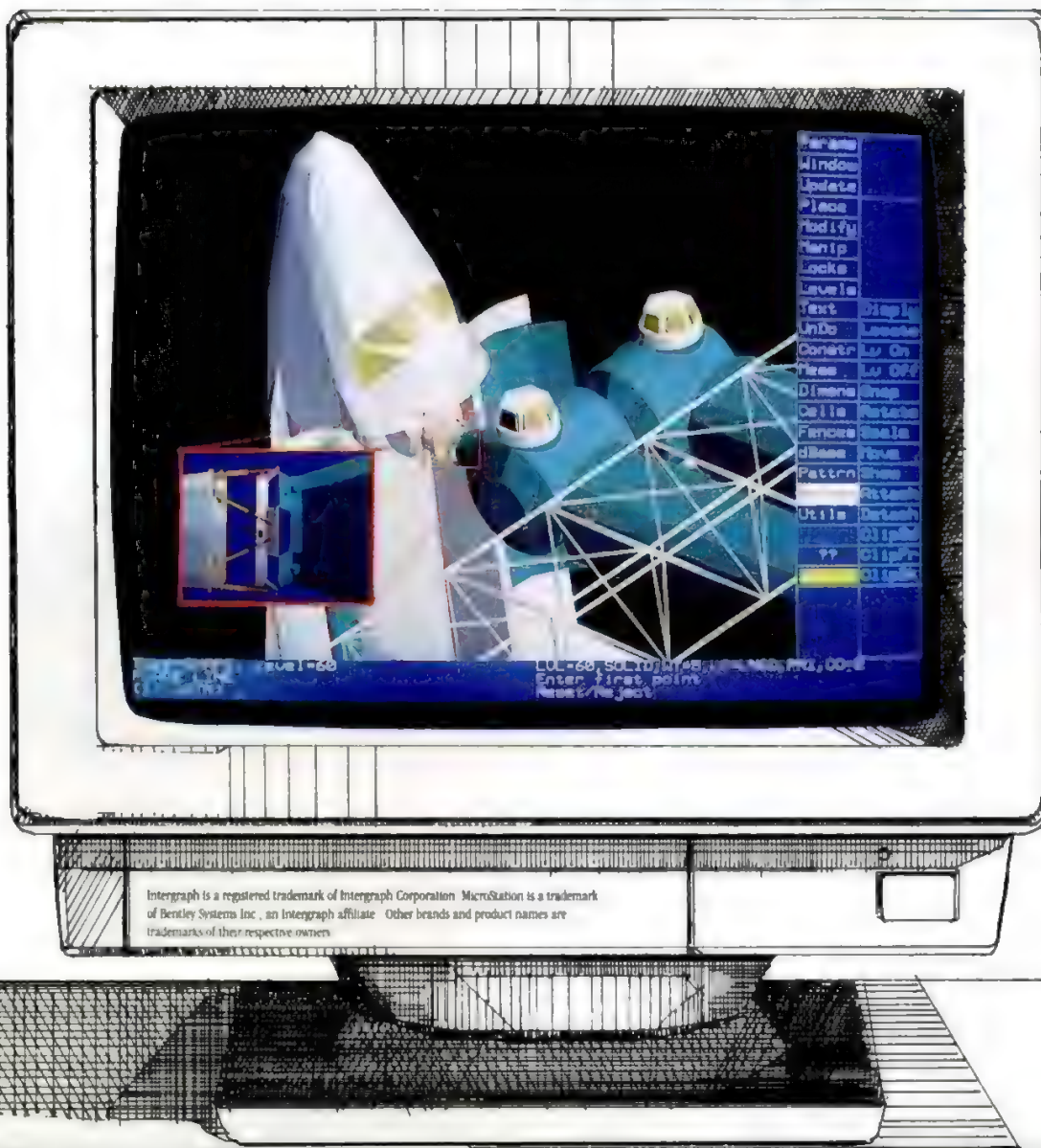
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doesn't return to the beginning of the next line for the CECHO command.

SETCURSOR can also hide the cursor. Just set the cursor to display on line 26, which is off-screen. You must issue a second SETCURSOR command that puts the cursor back on-screen once the hidden cursor is no longer needed, or you won't be able to see what you type! If you forget, don't panic: press Esc, blindly type CLS, and press Enter. Things will return to normal with the cursor homed to the top of the display.

```
243V56  
(EL=8 if successful; EL=1 if not)
```

This BATCHMAN command loads the 8 by 8 BIOS font for an EGA or VGA monitor. This changes the number of lines displayed to 43 (EGA) or 50 (VGA). You can use the DOS MODE command to return to the normal 25-line display.

```
PRFSC (EL=8)
```

This command will execute a printer screen dump exactly as if you had pressed Shift-PrtSc on an 83-key keyboard or the dedicated PrtSc key that you see on a 101-key keyboard.

```
COMPARE string1 string2  
(EL=8 if match; EL=1 if no match)
```

The BATCHMAN COMPARE makes a case-insensitive comparison between two strings. For most purposes you'll probably want to use COMPARE instead of the case-sensitive DOS batch command:

```
IF string1==string2
```

With the DOS IF string comparison, a non-case-sensitive match requires two tests—one for uppercase and one for lowercase. Even this does not guarantee a match if the string is a mixture of upper- and lowercase, as might occur if a batch file were looking for a person's name, for example. COMPARE solves this case problem. Note that the BATCHMAN COMPARE does not need the double equals signs the DOS IF command uses.

```
CANCOPY filespec [d:]  
(EL=8 if room to copy; EL=1 if not)
```

Before you copy a file or a number of files to another drive (especially a floppy disk drive), you can use CANCOPY to see if there is enough disk space for all the specified files. The *filespec* you supply can use both the DOS ? and * wildcards. If you don't specify the target drive, the default drive will be checked for available room. Thus, for example, to check whether the collection of *PC Magazine* utilities you keep in a directory called PCMAG on drive C: will fit onto a floppy, you would enter the command

```
BATCHMAN CANCOPY C:\PCMAG\*. * A:
```

BATCHMAN will return an EL of 0 if there is room for all the files; otherwise a 1 will be returned. If you enter this from the DOS command line, you'll want to include the /R option to see the EL returned on-screen.

```
WARMBOOT  
COLDBOOT
```

As their names imply, WARMBOOT and

Two of the BATCHMAN
commands will reboot
your system.

WARMBOOT does the
same thing as pressing
Ctrl-Alt-Del, whereas
entering COLDBOOT
is like pressing the big
red switch at the back
of your machine.

COLDBOOT reboot your system. WARMBOOT does the same thing as pressing Ctrl-Alt-Del; COLDBOOT is like hitting the big red switch. A COLDBOOT does a memory check (among other things) that WARMBOOT does not, and it takes a lot more time. Of course, be forewarned that with either of these commands, all unsaved data in RAM memory

will be lost. Note that WARMBOOT and COLDBOOT may not work on some non-compatible systems.

```
SHIFT ALT | CTRL  
(EL=1 if depressed; EL=0 if not)
```

This command returns the state of either the Alt or Ctrl key. For example,

```
BATCHMAN CTRL
```

returns an EL of 1 if the Ctrl key is currently depressed. You can use the SHIFT command along with the BATCHMAN GETKEY command without arguments to detect Alt-key presses. (See GETKEY, below, for an example.)

```
NUMLOCK [ON | OFF] (EL=8)  
CAPSLOCK [ON | OFF] (EL=8)  
SCROLLLOCK [ON | OFF] (EL=8)
```

These three commands toggle the current shift state of the NumLock, CapsLock, or ScrollLock keys when used without the ON or OFF options. They explicitly turn the three keys on or off if the optional arguments are supplied.

Thus, for example

```
BATCHMAN NUMLOCK
```

will toggle the NumLock state on if it was off or off if it was on. Entering

```
BATCHMAN NUMLOCK OFF
```

will turn the NumLock state off regardless of whether it is currently on or off. This would be a useful line in your AUTOEXEC.BAT if you use the numeric keypad for cursor navigation instead of number entry. Note that on some keyboards the LED indicator lights may not faithfully track changes in shift status.

```
RENDIR old new (EL=8 if  
successful; EL=1 if not)
```

Long-time users of our utilities will recognize this command, as it performs the same function as the standalone RENDIR utility published in our April 15, 1986, issue. The version presented here will rename a directory, but only on systems using DOS 3.0 or later. To use it, simply enter the path of the *old* directory and the *new* name.

Imagine, for example, that you want to rename a temporary directory, designated

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TMP, on the C: drive. If the permanent name is, say, ROBIN, you would enter

```
BATCHMAN RENDIR C:\TMP C:\ROBIN
```

Be sure to include the complete path for both the old and the new directory names if the directory is other than the default.

```
ROMDATE {EL=#}
```

ROMDATE displays the 8 bytes of the BIOS date at address FFFF:0005 of the ROM BIOS. Usually, the display will be something like 10/07/87, but some clone BIOSs do not have a date. If no ASCII numbers are found, BATCHMAN displays nothing.

```
GETKEY ['string' n] {EL=scan code  
if no ['string' n] list; else  
EL=position in list.}
```

There are probably hundreds of versions of the batch file GETKEY program. And each version returns the scan code of the next key you press as an EL value. Furthermore, if you enter the BATCHMAN GETKEY command without the optional (bracketed) arguments, it will perform the same task.

If it is entered without arguments, the GETKEY command can also be used with the BATCHMAN SHIFT command to detect Alt- or Ctrl-key combinations. The scan code for the Q key is 16. In order to check for an Alt-Q keypress (perhaps as a Quit key command), you would use the following batch file:

```
ECHO OFF  
:GETKEY  
BATCHMAN GETKEY  
IF NOT ERRORLEVEL 16 GOTO GETKEY  
BATCHMAN SHIFT ALT  
IF NOT ERRORLEVEL 1 GOTO GETKEY  
ECHO Alt-Q was pressed.
```

GETKEY provides still another kind of functionality with its optional key list. The information you need may not be the scan code of a given key, but rather its position in a string. If you supply the optional 'string' argument to GETKEY, BATCHMAN will wait either until one of those keys listed has been pressed or until you break out of the command with Ctrl-Break

or Ctrl-C. An example may be helpful here. With the command

```
BATCHMAN GETKEY 'yn'
```

BATCHMAN will wait until either the Y or the N key or one of the break keys mentioned above is detected. All other keypresses are ignored, and if the break-out keys are pressed, the EL returned will be 255. GETKEY is not case-sensitive, so if either Y or y is pressed, the EL will be 1, since the y is the first character in the string of valid keypresses. For N, an EL of 2 will be returned.

The string must be enclosed in a pair of either single or double quotes. If you want the single quote included as a valid keypress, enclose it in double quotes and vice versa for double quotes, as in the following example:

```
BATCHMAN GETKEY ''''
```

You can also include the function keys (even the F11 and F12 keys of the extended keyboard) in the GETKEY list. The function key numbers are listed without quotes, (they are designated by the *n* in the command syntax above), and may or may not be further identified with a leading "F." Multiple function keys are delimited by either a space, comma, or semicolon. To add the F1 and F2 as valid keys to the "yn" string example above, you would enter either

```
BATCHMAN GETKEY "yn" F1 F2
```

or just

```
BATCHMAN GETKEY "yn" 1 2
```

If F1 is now pressed, the returned EL will be 3, since F1 is the third entry in the list.

```
DOSVER {EL=(major*32)+minor}
```

DOSVER returns an EL representation of the DOS version in use. DOS version numbers have two parts, the major version (the number to the left of the decimal point) and the minor version (the number to the right). For DOS 3.10, then, 3 is the major and 10 is the minor. Since the largest EL number is 255, the DOS version number does not fit conveniently into an EL. For DOS 3.10, for example, if the dot is discarded, the remaining 310 is too large for an EL.

Of course, BATCHMAN could be con-

tent to return only the major number, truncating anything after the dot, or even the first digit after the dot. But that would be less than sufficient for some applications. So instead, the DOSVER command *compresses* the version number by multiplying the major number by 32 and adding it to the minor number. With DOS 3.30 the result will be $(3*32)+30=126$; with DOS

If you want to run a program or perform a task, don't rely on trial and error to check for space. One of three BATCHMAN commands will find out if there is enough main, expanded, or extended memory.

4.00 it would be 128. If there had been a DOS 3.32, we would have a problem, of course, since this would also return 128. Historically speaking, however, we are safe here.

```
MAINMEM n | R {EL=# if enough}  
EXPMEM n | R {EL=# if enough}  
EXTMEM n | R {EL=# if enough}
```

The arguments for these three memory commands can either be a decimal number, *n*, or an R. The decimal argument is used to check whether the desired amount of memory (in K) is free. If there is enough free memory to meet the request, the EL will be 0. Thus, if an application needs 512K of the 640K maximum possible with DOS, you would enter

```
BATCHMAN MAINMEM 512
```

The EL will return 0 if there are at least 512K bytes free; otherwise, 1. Your batch file can then branch to an error message if there is not enough memory to run the application. Note that these memory com-

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mands do not allocate the memory. They only check to see if it is free.

The alternative R argument stands for Report and will display the current free memory of the type requested on the screen. To see how much free expanded memory you have, for example, enter

```
BATCHMAN EXPMEM R
```

The report option of the three types of memory will go nicely with BATCHMAN's ROMDATE command in a system information batch file.

```
DISPLAY {EL=display type}
```

The DISPLAY command will report on the type of display your system has installed. The values returned by DISPLAY as EL codes are

```
1=MDA
2=CGA
4=EGA color
5=EGA mono
6=PGS
7=VGA mono
8=VGA color
11=MCGA mono
12=MCGA color
```

Similarly, the CPU command

```
CPU {EL=CPU type}
```

returns an EL that indicates the microprocessor used by your machine. The specific EL numbers are 1=8086/8088; 2=80186; 3=80286; and 4=80386.

```
WINDOW m,n,w,h[,c,b] {EL=0 if
successful; EL=1 if not}
```

The powerful WINDOW command displays screen boxes. It provides several parameters and options. The first two decimal numbers (*m,n*) are the row and column of the top-left corner of the window. The next two decimal numbers (*w,h*) are the desired width and height of the window (including the border characters).

The smallest size that WINDOW allows is two characters in width and height. The optional fifth parameter, *c*, can be either a hexadecimal or decimal number for the color of the window. If no color argu-

ment is supplied, the current color of the screen is used by default. The last parameter, *b*, sets the type of border used to surround the window. If no parameter is found, spaces are used. If you enter a minus sign for *b*, a single-line box character will be drawn. An equals sign for *b* will

**Certain BATCHMAN
commands will return
information on the
configuration of your
system. DISPLAY, for
instance, returns an EL
value that indicates
the specific kind of
display and whether it is
monochrome or color.**

produce the double-line box character. In all cases, the center of the window is cleared with spaces of the chosen color. For example, the command

```
BATCHMAN WINDOW 1,1,80,25,17h,=
```

creates a blue window with white double-line box characters that will fill the entire screen, making a nice menu frame. Text could then be added with the BATCHMAN SETCURSOR and CECHO commands.

```
TYPEMATIC [m,n | N] {EL=0 if
valid parameters; EL=1 if not}
```

```
INSERT 62(2)-12 lines
```

```
m=typematic rate (0 - 31);
larger m=faster rate
```

```
INSERT 62(2)-12 lines
```

```
n=initial delay (0 - 3);
larger n=longer delay
```

```
N=normal: m=20; n=1
```

```
default: m=25; n=0
```

TYPEMATIC works only with keyboards that support adjustable typematic (auto-

matic key repeating) rates at the BIOS level. This includes most machines, starting with the AT, but not all clones.

The first optional decimal parameter, *m*, is a number between 0 and 31 that represents the desired typematic rate. The larger the *m* value, the faster your keyboard will repeat keystrokes. The second parameter, *n*, has a range of 0 to 3, and it sets the initial delay. This delay is the length of time you must hold down a key before it begins repeating. The larger the delay value, the longer the delay. The delay parameters are in quarter-second increments, with 0 = 1/4 and 3 = 1 second. The typematic parameters are divisors and cannot easily be translated into fractions of a second, however, so they should be thought of only as gradient scales.

If you don't enter any parameters, TYPEMATIC defaults to what I consider ideal, a repeat rate of 25 and a delay of 0. The 25 translates into about 17 characters per second with an initial delay of a quarter second. You can restore the typematic rate to the normal hardware defaults (11 characters per second with a half-second delay) by using the N parameter. Just enter

```
BATCHMAN TYPEMATIC N
```

and the normal values of 20 and 1 will be used. Once you try adding a little zoom to your keyboard, however, I don't think you'll ever go back to the hardware defaults.

Hopefully, the comments in the assembly listing will suffice for those interested in the programming techniques. BATCHMAN is designed so that programmers can easily add their own commands. All you need to do is add a procedure for the new command and add the name of the command to the dispatch table. Once you've had a chance to look at the listing, I think it will be self-explanatory. And, of course, as I mentioned above, I can always be found on PC MagNet. Come and join me there and we can delve into the technical details together.

Whether you are a programmer or not, however, BATCHMAN will make your system significantly more responsive to your needs. To see just how flexible BATCHMAN can be, check out this issue's Lab Notes, where Neil J. Rubenking will take BATCHMAN and literally make it sing. ■

Michael J. Mefford is a contributing editor of PC Magazine.

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by
Charles Petzold

Environments

The three-month lapse between the time I write these columns and the time you read them is a long time in this industry. And try as I do to stay ahead of events, they sometimes overtake me.

The Environments columns in our October 17 and October 31, 1989, issues are a case in point. When I wrote those columns in July, Microsoft had not officially acknowledged or addressed my problems with rendering text on video displays and printers under the OS/2 Presentation Manager. At the Seybold Computer Publishing Conference in September, however, Microsoft made two major announcements that affect the future fonts of the Presentation Manager.

A QUICK BACKGROUNDER

The Graphics Programming Interface (GPI) component of the Presentation Manager supports two very different font formats. With the raster (or image) format, each character in a font is defined by a small bitmap; and with the vector (or outline) format, each character is defined by a series of lines and curves that the GPI fills when it displays the character.

Vector fonts are much more versatile than raster fonts. They can be scaled to any size and used on any output device (video display or printer) of any resolution. Raster fonts, by contrast, are limited to one size and one display resolution. Only with vector fonts can we begin to realize true WYSIWYG ("what you see is what you get") in PM word processing and desktop publishing programs.

Currently, however, vector fonts have two major problems: performance and legibility. The performance problem results from the lengthy processing step (sometimes called "rasterization") required to convert an outline into a displayable character.

A Follow-up on Font Technology for the Presentation Manager

This problem can be somewhat alleviated by using a technique called "font caching." With font caching, once a character is rasterized it is saved in a cache for future display.

The legibility problem is more difficult. Each character in a vector font is defined by a series of lines and curves based on an arbitrary coordinate system. When scaling the font to a desired size and device resolution, GPI must adjust each coordinate point. It's unlikely that the resulting coordinate points will coincide exactly with the pixels of the output device. This causes rounding errors that can make the characters nearly unreadable at the normal font sizes on common video displays, such as the VGA. The problem is much less seri-

ous on laser printers, but it still exists.

What the GPI desperately needs is *intelligent scaling*. The vector font must consist of more than a collection of lines and curves: it must include a set of "hints" (specialized algorithms) that ensure that the scaled coordinate points coincide with pixels in a consistent manner that preserves fidelity to the original font design.

Intelligent font-scaling technology already exists. Adobe has used it for years in PostScript, and other font manufacturers (for example, Bitstream and Agfa/Compugraphics) have developed their own "hinted" vector fonts, as well.

TWO PROBLEMS: TWO SOLUTIONS

Back in July, the betting in the industry was that Microsoft would shortly announce an "installable font" specification for the Presentation Manager. This would have allowed font manufacturers to sell PM font files that included intelligent scaling algorithms. Thus, each font manufacturer could handle intelligent scaling in its own way. It seemed to me an ideal solution that favored no single font manufacturer.

What Microsoft actually announced at Seybold, however, was not the predicted installable font specification. Instead, Microsoft revealed that it had struck a very interesting deal with Apple, which had designed an intelligent font-scaling tech-



ILLUSTRATION: STEVE DENING

Environments

nology for its forthcoming Macintosh System 7 operating system. This technology (code-named "Royal") will now be made part of the Presentation Manager, as well.

Nor was that all. Not content with a single solution to the font problem, Microsoft presented a second, as well, announcing that a different intelligent font-scaling technology (specifically, Compugraphics' Intellifont) would be made part of a future version of the Presentation Manager printer driver for the Hewlett-Packard LaserJet.

Why two different solutions? Because there are two problems. Once you identify them it becomes fairly obvious why each requires a different solution. At the Seybold Conference, the Microsoft-Apple deal greatly overshadowed the news about the LaserJet printer driver. Here, however, I think the dual-solution approach will make more sense if I discuss the printer driver issue first.

FONTS AND LASER PRINTERS

In recent years, two companies have set the standards for laser printers: Adobe (the creator of the page description language known as PostScript) and Hewlett-Packard (manufacturer of the popular LaserJet series, which uses a printer control language known as PCL).

PostScript printers nowadays usually come with 35 built-in, scalable fonts. Adobe also sells over 500 downloadable fonts for PostScript printers. For the LaserJet, font cartridges and downloadable fonts from a wide variety of vendors are available to supplement its built-in fonts.

Many PC users have made a considerable investment in laser printers, either directly by buying LaserJet font cartridges and downloadable fonts, and/or indirectly by paying Adobe for the use of PostScript. Owners of these printers naturally want their PM programs to use the fonts that are available on their printers. In the graphical world of the PM, word processing programs, drawing programs, and desktop publishing programs will all need to show on the video display what a document will look like when it is printed.

So, the first problem Microsoft had to solve is this: how can the Presentation Manager provide screen fonts that correspond to fonts that are available on the printer? And how can this be done in a manner that is transparent to both the user

and to the application program?

To answer these questions, let's take a look at the piece of Presentation Manager software that knows the most about a particular printer: the printer driver.

THE PRINTER DRIVER

Each printer that can be used from the Presentation Manager must have a printer driver, which is actually a dynamic link library with the filename extension .DRV. The printer driver is principally responsible for translating GPI drawing commands into a protocol that the particular printer can understand. All the code specific to a particular printer is encapsulated in the printer driver.

**OS/2 will soon include
printer drivers that
allow the Presentation
Manager to create
screen fonts identical
to the fonts available
on your printer.**

When you configure a printer from the Control Panel in OS/2 1.1 or from the Print Manager in OS/2 1.2, the printer driver displays one or more dialog boxes that let you tell it about your printer.

For example, you have to tell the PostScript printer driver which specific printer you have, since different PostScript printers have different fonts. The printer driver knows what fonts are available on each PostScript printer that it supports. The driver also knows the "metrics" (for example, the character widths) for each of these fonts. When you configure a LaserJet, you tell the printer driver what font cartridge you're using. The printer driver knows about the fonts that are available on each cartridge. Printer drivers can also be made responsible for downloading software fonts to the printer, so they know about these fonts also.

All this information is available to Presentation Manager applications. A PM program can determine the fonts available on a particular printer and the metrics of

these fonts. This is fine for using the fonts on the printer, but what if the program also wants to use these same fonts on the video display? Where will the matching screen fonts come from?

The printer driver knows the printer more intimately than any other software in the system. It makes sense, therefore, to make the printer driver responsible for creating screen fonts that duplicate the fonts available on the printer.

This is the basis, then, of Microsoft's first solution to the font problem. The Presentation Manager will allow printer drivers to make available vector-based screen fonts that duplicate printer fonts. Specifically, Microsoft will work with Hewlett-Packard to create a new printer driver for the LaserJet that will do this. In the same vein, Microsoft has also expressed an interest in working with Adobe to create a new PostScript driver that generates screen fonts that duplicate PostScript printer fonts. How these fonts are actually generated by the printer driver will be the concern of the driver, not of the PM.

To recap, then, the first problem involves obtaining screen fonts that duplicate existing printer fonts. The solution is to let the printer driver generate these fonts for the Presentation Manager.

BEYOND PRINTER FONTS

The second problem is this: How do we get Presentation Manager screen *and* printer fonts that go beyond what is available on the printer itself?

For this solution, Microsoft went to Apple. Apple had been developing an intelligent vector font-scaling technology known internally as "Royal." (I'll keep calling it Royal, even though the system may eventually be given a different name.) Royal is slated for inclusion in the Macintosh System 7, which is expected sometime in 1990. The deal between Microsoft and Apple allows Microsoft to include this technology in a future version of the Presentation Manager.

From everything I've heard, Royal is hot stuff. It is actually a programming language designed for intelligent vector font scaling. Apple worked with many font manufacturers to determine which algorithms and programming capabilities they needed to do their jobs. Royal includes everything that anybody needs and even a little more. Thus, it should be fairly easy for font manufacturers to create fonts in the Royal format.

Moreover, Royal fonts for the Macin-

Environments

tosh will be basically the same as Royal fonts for the Presentation Manager. (The main difference involves Apple's use of a single 256-character set and the Presentation Manager's use of multiple codepages, each of which uses 256 characters selected from a larger character set.)

Achieving font compatibility between the PM and the Mac creates an instant de facto standard. Font manufacturers can be assured of two markets when they create fonts in the Royal format. The result? We're going to be up to our eyeballs in third-party Royal fonts—and we'll love every minute of it!

When the Royal technology is first implemented in the Presentation Manager, it will probably include 14 standard fonts: Courier, Helvetica, and Times Roman in normal, bold, italic, and bold italic versions, plus a symbol font and a dingbat font. (Dingbats are the little asterisks and bullets and other designs commonly used to dress up documents.) It's likely that Apple will include the same fonts in System 7. This means that any document that uses these 14 standard fonts will be interchangeable between the Mac and PM.

These fonts can be used on all graphics output devices (video displays, laser printers, dot matrix printers, and plotters) that the Presentation Manager supports. They will probably not be as fast as the printer's built-in fonts, but that's a tradeoff we may have to learn to live with.

DUMB PRINTERS

The inclusion of sophisticated vector font technology in the Presentation Manager may also open up a market for another type of hardware: the dumb laser printer.

Why do we need fonts built into our laser printers if we have fonts in the Royal format stored on our hard disks and usable by any Presentation Manager program on any graphics output device? Why do we need intelligent printers that understand incompatible programming languages and control codes? It should be possible for a printer driver to perform an entire printer page imaging operation entirely in the PC. This involves creating a large bitmap (about 1MB for an 8½-by 11-inch page on a 300-dot-per-inch laser printer), drawing everything on this bitmap, and then sending it out to the printer.

Indeed, this is what *is* done in the NeXT

machine. The NeXT laser printer is cheap because it doesn't have to do anything except print a page that has already been composed by the computer.

Of course, we'll probably want a high-speed link between the PC and printer so that megabyte bitmap can be transferred quickly. But imagine a laser printer without lots of software and fonts in ROM, no font cartridges, not even an on/off switch. Such a machine could easily have a list price under \$1,000.

DEVICE INDEPENDENCE IMPLICATIONS

Every move away from built-in printer fonts towards GPI software fonts means getting that much closer to the goal of device independence.

Fonts have always been a major problem in device-independent graphics. Raster fonts are device-dependent because they must be designed for the particular resolution of an output device. Using built-in fonts is device-dependent because different printers support different fonts.

For example, suppose you create a document in a desktop publishing program. Before you begin, you must select a destination printer. You pick a PostScript printer. The program lets you use PostScript fonts in the document, and it will use the PostScript font metric information to calculate line breaks and spacing.

Now you give that document file to somebody with a LaserJet. A problem arises. The program has to substitute LaserJet fonts for the PostScript fonts (either by itself or with your assistance), and it must then recalculate all of the line breaks—perhaps disturbing crucial elements of the document layout in the process.

Now suppose you create a document that uses only Royal fonts. It doesn't matter what the destination printer is because the same Royal fonts are used regardless of the printer. You could even give the document to someone who has the equivalent desktop publishing program running on a Macintosh with System 7.

Getting a good standard vector font technology into the graphics system of the Presentation Manager and the Macintosh will finally give us a way to display the same text and graphics on any video display and any graphics printer usable with either of the two machines.

WHY A NEW STANDARD?

Is Royal really necessary? After all, there already *is* a graphics system called Post-

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Script that includes a good vector font technology.

There is no question that PostScript is a remarkable conception and implementation of a device-independent page composition language. Although most programmers find its Forth-like syntax awkward,

PostScript is a complete and versatile language. PostScript has been very influential in sparking the desktop publishing revolution, and Adobe is likely to remain a significant force in the industry.

But PostScript was designed for the printed page, not for the video display. Video displays impose different requirements on a graphics system. Printer graphics don't have to move; screen graphics do. You need much better bitmap support and

raster operations than currently exist in PostScript. And Adobe's attempt to bring PostScript into the video realm with Display PostScript has not met with much enthusiasm in the industry, Steve Jobs and his NeXT machine notwithstanding.

What's worse, Adobe simply did not play by the rules. Although third-party font manufacturers could create fonts for PostScript printers, Adobe kept to itself the ability to create the "Type 1" fonts that use PostScript's proprietary algorithms. The rules of this industry say: you can make money with your product, but you must let third-party manufacturers of product add-ons (such as fonts) play on the same-level field.

After the announcement that Microsoft would be using Royal fonts in the Presentation Manager, of course, Adobe pledged to open up the Type 1 format. But I suspect it's a little too late. The industry has been recently inching away from Adobe for many reasons: Adobe's proprietary "hinting" algorithms, licensing fees widely considered to be excessive, the company's reluctance to extend the graphics capabilities of PostScript, and the emergence of PostScript clones and better vector font technology.

Of course, nobody is suggesting that PostScript or PostScript printers will become useless. The Presentation Manager already has a PostScript driver that can generate PostScript code for PostScript printers and typesetters. It's also quite likely that Royal fonts will have the same metrics (character widths and so forth) as PostScript fonts. Thus, you can use Royal fonts on the screen and print with PostScript fonts on a PostScript printer and achieve both device-independence and reasonable printing speed.

Still, Adobe's dominance in the font and desktop publishing arena is on the wane. The world has a new font standard.

THE TIME FRAME

And now for the bad news. When will we see the Royal font technology implemented in the PM? That, I'm afraid, is still not yet clear. It will likely not appear in the first release of OS/2 2.0, but in a later release, possibly by the end of 1990. (Of course, by the time you read this column, you may know more than I do now!)

So once again we wait, as we have waited for OS/2 2.0, tantalized by the potential of this technology, eager to face this new decade of computing, seeing into the future but not yet able to grasp it. ■

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by
Craig Stinson

Spreadsheets

Last issue, we began discussing *Lotus 1-2-3*, Release 3. I'd like to conclude that discussion in this installment.

CONNECT TO EXTERNAL DATABASES

Release 3 doesn't merely add a third dimension to *1-2-3*. Its database capabilities have also been significantly enhanced.

/Data External is perhaps the most far-reaching but certainly not the only major addition to the database wing of *1-2-3*. This command allows you to establish live connections between *1-2-3* worksheets and files managed under *dBASE* or other true database products. Once you have established the connection between the worksheet and an external database, you can interact with that database as though it were an ordinary *1-2-3* data table.

To use */Data External* you must install a driver for your external database program. Lotus supplies a sample driver, named *SAMPLE*, for *dBASE III*. It works only with *dBASE III*, not with *II* or *IV*, and it does not implement all the features inherent in */Data External*. But it will get you acquainted with the new possibilities. (By the time you read this, third-party drivers for other programs may be available.)

Typically, the first thing you'll do with */Data External* is establish a link with an external table via */Data External Use*. This procedure assigns a range name alias to the external table. Thereafter, you can use the assigned range name as the input argument for any database statistical function or the input range for */Data Query Find*, */Data Query Extract*, or */Data Query Unique*. If your driver allows (the *SAMPLE* driver does not), you can also send a command to the database program using */Data External Other Command*, or you can update external records with */Data Query Modify Replace* or */Data Query Modify Insert*.

To establish a link to an external table, enter */Data External Use*. Then supply *1-2-3* with the name of the database driver, a "database name," a table name, and the range name you want to assign as alias for the external table. *1-2-3* will prompt and

■ Are enhanced database capabilities, new graphing features and formatting options, more worksheet functions, and everyday conveniences reasons to upgrade to *1-2-3*, Release 3?

present default values for each item. If a password is attached to the table, the external database driver will prompt you for the password.

The database name is not the title of your external DBMS program; it's the full path of the subdirectory containing the table to which you want to connect. Release 3's terminology assumes that you keep all related tables in a common subdirectory and that the collection of tables in that directory constitutes a "database." If you prefer to see what you're working with (and you have enough RAM), you can easily bring all records from an external table into memory.

To do this, use */Data External Use* to set up the external link. Then use */Data External List Fields* to generate a table in *1-2-3*

that defines the external table. For a simple payroll history file (we'll call it *PAYHISTORY*), such a table might look like the one shown in Figure 1.

The first three columns in this table report the field name, the data type, and the width of each field. (For numeric fields, the numbers before and after the comma are the width of the field to the left and right of the decimal point.) The last three columns report alternate field headings (Federal Income Tax or FIT, for instance), field descriptions, and field-creation strings. The last three are not used by the *SAMPLE* driver, but your external driver may use them.

Once you have the field headings listed, you can use */Range Transpose* to line them up horizontally. Set up a criteria range with the horizontally arrayed headings and a blank row below them, as well as an output range with another copy of the headings. Then use */Data Query Extract* to create an internal table consisting of all records contained in the external table.

If your database driver permits, you can reverse this process and thereby create a new table on-disk for use in an external DBMS program. With this reverse process you can also copy records from *1-2-3* to that table. The procedure for doing this in-

A SAMPLE TABLE-DEFINITION FILE					
Field Name	Data_Type	Width	Alternate Field Heading	Field Description	Field Creation String
PAYDATE	Date	8	NA	NA	NA
EMPID	Numeric	5,0	NA	NA	NA
HOURS	Numeric	8,2	NA	NA	NA
RATE	Numeric	8,2	NA	NA	NA
GROSS	Numeric	8,2	NA	NA	NA
FIT	Numeric	8,2	NA	NA	NA
FICA	Numeric	8,2	NA	NA	NA
SIT	Numeric	8,2	NA	NA	NA
SDI	Numeric	8,2	NA	NA	NA
NET	Numeric	8,2	NA	NA	NA
PAID	Date	8	NA	NA	NA
CHECK_#	Character	9	NA	NA	NA

Figure 1: The */Data External List Fields* command sequence generates a six-column table representing the field structure of your external data file. Only the first three columns are used by the *SAMPLE dBASE* driver included with Release 3.

Spreadsheets

volves creating a table-definition table (similar to the one shown above for PAYHISTORY) and using the /Data External Create command.

ENHANCEMENTS TO /DATA QUERY

The /Data Query branch of the menu tree has been strengthened in several ways. First, there's a new /Data Query Modify command that lets you update (append or amend) records in an input range after you have performed an extract. This is particularly valuable when the input range is an external database table or an "inactive" 1-2-3 table (one that's not currently in memory).

/Data Query Modify has four subcommands: Extract, Insert, Replace, and Cancel. /Data Query Modify Extract works just like /Data Query Extract, except that when you use /DQME, 1-2-3 remembers the positions of the extracted records in the input table.

/Data Query Modify Replace copies records from the output range (presumably after you have modified them) back to the input range. /Data Query Modify Insert gives you a way to add new records to an input range. The command appends records from the output range to the end of the input table. "Output range" is sort of a misnomer in this situation because the records that get appended to the input range

are presumably new data; they don't have to be the result of a /Data Query Modify Extract.

/Data Query Modify Cancel causes /Data Query Modify to abort the modify operation without making any changes in the input table.

The other modifications in /Data Query have to do with the way queries are formulated; the effect of these changes is the creation of a system that's more powerful and easier to use.

/Data Query Input now accepts multiple input ranges, enabling you to perform Extracts and Finds on two or more tables simultaneously. When you want to specify more than one input range, use /Data Query Input and type a comma (or the current argument separator) after each input range. If you are planning to use queries that involve common field names in two or more tables, you must assign names to each input range.

Criteria specification is now both easier and more powerful. To extract a subset of records based on a simple comparison of a field value to a constant, you're no longer required to write a formula involving a dummy value from the first record of the database (though you may if you wish). To get all LASTNAMEs greater than S, for example, you don't have to say +B2>"S". It's enough to enter the label '>S' under the heading LASTNAME.

In order to specify a range of values in a designated field, you can now repeat the field heading in the criteria range. For ex-

ample, the following criteria range

LASTNAME	LASTNAME
>S	<T

will get you all surnames starting with S and no others. (In fact, if you take this "label" approach, you have to repeat the heading to get ANDed comparisons; an #AND# embedded in the label will be evaluated as text.)

When you do write formulas in a criteria range, you can now reference the field names instead of first-record addresses. Release 3 creates implicit names for each field heading.

A criterion formula can now include database statistical functions. Such functions can reference either the same database being queried by the criteria range or any other active, inactive, or external database. So, for example, to extract records with salary values greater than the average salary for the database, you can write the criterion formula

```
SALARY+Salary>@davg(PERSONNEL,  
"SALARY",SELECTALL)
```

where PERSONNEL is the input range, "SALARY" is a reference to the salary field (remember, database functions can now use field names in quotes in place of column offsets), and SELECTALL is a separate criteria range that selects all records in PERSONNEL.

When you're working with two or more input tables that share some common field names, your criteria field headings must include the table names as well as the field names. Use a period to separate the table name from the field name. For example,

```
PAYHISTORY.EMPID  
PERSONNEL.EMPID
```

You can perform a join operation, combining two tables on a common field to create a third table, by writing the criteria formula

```
+PAYHISTORY.EMPID=PERSONNEL.EMPID
```

OR

```
+C2=F2
```

where C2 and F2 are the first-record addresses for the two EMPID fields.

Your output range can now include two kinds of computed fields: simple comput-

A SAMPLE PERSONNEL TABLE

LASTNAME	LOCATION	SALARY	AGE	PROFITSHARING
Edwards	Atlanta	32200	44	Yes
Percival	Atlanta	19200	36	Yes
Reese	Atlanta	15800	23	No
Santos	Atlanta	17200	26	Yes
Savage	Atlanta	18900	26	No
Adamson	Boston	34400	46	Yes
Bird	Boston	21100	38	Yes
Caulfield	Boston	24100	40	Yes
Cobb	Boston	27500	42	Yes
Fletcher	Boston	16500	22	No
Johnson	Boston	20200	35	No
Kaplan	Boston	34000	44	Yes
Bjorkman	Chicago	25000	23	Yes
Krauss	Chicago	26200	41	Yes
Lerner	Chicago	24900	29	No
Morse	Chicago	19600	23	No
Tallan	Chicago	19700	27	No
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King	Detroit	18100	24	No
Mosley	Detroit	20800	34	No
Robinson	Detroit	17000	23	No
Rosenzweig	Detroit	19000	33	No
Edwards	San Franci	21500	27	No
Mintz	San Franci	30440	45	Yes
Stolper	San Franci	17800	23	No

Figure 2: With aggregate formulas, you can easily compute such things as the average age and average salary at each location in the table.

Spreadsheets

ed fields and aggregate fields. Here are some sample simple computed fields as they might appear in your output range:

+SALES*COMMISSION
+SALES*.085
+SALES*\$COMMISSION

In the first of these, SALES and COMMISSION are both names of fields in the input table. In the second, SALES is an input field, and the formula multiplies the SALES value for each extracted record by the constant .085. In the third example, SALES is again an input field and \$COMMISSION is an absolute reference to a named cell outside the table.

Simple computed fields can use any arithmetic operators and any functions other than @AVG, @COUNT, @MIN, @MAX, and @SUM (and their @D equivalents). The formula itself is the output field heading, so you probably want to format it as text.

Aggregate fields are much more powerful than simple computed fields. They use statistical functions (@AVG, @COUNT, @MIN, @MAX, and @SUM) to compute formulas based on groups of selected records. For example, suppose you are working with a personnel table like the one shown in Figure 2. The following output range gives you an idea of what you can do with aggregate formulas.

A	B	C
1	LOCATION	@AVG(AGE) @AVG(SALARY)

The records extracted to this output range might look like this:

LOCATION	@AVG(AGE)	@AVG(SALARY)
Atlanta	31.0	20660
Boston	38.1	25400
Chicago	28.6	23080
Detroit	29.4	19760
San Francisco	30.5	21810

For each location in the input table, the aggregate formulas in columns B and C compute average age and salary. You could include more "nonaggregate" field headings in this output range to break down the analysis further, as shown in Figure 3. And you could use a criteria range to filter the records, so that the aggregate formulas would be run against only a subset.

REFINING AN ANALYSIS USING NONAGGREGATE FIELDS

LOCATION	PROFITSHARING	@AVG(AGE)	@AVG(SALARY)
Atlanta	No	24.5	17350
Atlanta	Yes	35.3	22067
Boston	No	28.5	18350
Boston	Yes	42.0	28220
Chicago	No	26.3	21400
Chicago	Yes	32.0	25600
Detroit	No	29.4	19760
San Francisco	No	25.7	18933
San Francisco	Yes	45.0	30447

Figure 3: By including the PROFITSHARING column in this output range, you can break down the analysis to compute average age and salary for those employees with and without profit sharing in each city.

For example, by putting

A
1 PROFITSHARING
2 No

in your criteria range, you could generate average age and salary figures for just the non-profit-sharing employees, broken down by location.

OTHER DATABASE ENHANCEMENTS

With Release 3 you can now specify up to 255 key columns for sorting database records. The /Data Sort menu doesn't actually include commands for each of those keys. Instead it has the usual Primary-Key and Secondary-Key plus a new option called Extra-Key. The Extra-Key command knows exactly how many keys you've already specified, so if you've already named 13, it will automatically prompt you for key number 14.

The /Data Table facility has been extended into the third dimension. The new /Data Table 3 command sequence in Release 3 does sensitivity analysis based on three input variables. The result is a series of rectangular tables laid back to back on successive worksheets, with each worksheet's table testing the third input against the first two.

Let's create a three-way table. Suppose you want to test the future value of a regular series of monthly deposits, given various deposit amounts, interest rates, and terms. For the sake of simplicity, we'll assume the interest rate will be variable 1, with values of 9%, 10%, and 11%; the deposit amounts will be variable 2, with amounts of \$100, \$200, and \$300; and the term will be variable 3, with amounts of 20, 30, and 40 years.

To set up the table, you would start by putting variable 1 in a column and variable 2 in a row, exactly as though you were set-

ting up a two-way table, like this:

	100	200	300
9%			
10%			
11%			

Leaving the upper-left corner cell of the table blank for the time being, you would use /Worksheet Insert Sheet After 2 to insert two new blank sheets behind this one, and then copy this fledgling table into each of the new sheets. Then you would line up the values for your third variable in the corner cell of each sheet, so the first sheet would have 20 in the upper-left corner, the second 30, the third 40.

With your variables in place, then, you would choose three cells outside the table to serve as inputs for the three variables. And in a fourth cell—anywhere outside the table—you would write your @FV

**With Release 3 you
can specify up to 255
key columns for
sorting records.**

formula. If your three input cells were B1, B2, and B3 (representing interest rate, monthly deposit amount, and term in years), your formula would read

@FV(B2,B1/12,B3*12)

Then you use the /Data Table 3 command and supply the table location, the formula location, and the location of each input variable. /2-3 does the rest.

Spreadsheets

NEW GRAPHING FEATURES

Release 3 offers a host of new graphing services, including new graph types, many more customization options, the ability to use two y-axes, the ability to print graphs without leaving 1-2-3, the ability to see a graph and its underlying worksheet data simultaneously, optional logarithmic scaling, and several welcome convenience features. These changes still don't bring 1-2-3 up to parity with *Microsoft Excel* as a charting machine (nor will they threaten Lotus's own *GraphWriter* and *Freelance* products); nevertheless, they add up to significant if not dramatic improvement.

The new graph types are high-low-close-open, mixed line and bar, area, and pie-bar. The HLCO graphs can be split to show daily market volumes as well as prices. The pie-bar is implemented as a customization instead of a separate type; use /Graph Type Features 100% to generate this kind of graph.

You can also rotate any graph except a pie, so that bars, for example, extend outward from the y-axis instead of upward from x. To do this, use /Graph Type Features Horizontal.

The text options include two new footnote lines (annotation below the graph) but still no floating, or unattached, text. Any text on the graph can now be keyed to worksheet labels (and 1-2-3 maintains the references even if you move the labels); and for any text, you may choose from eight color values, eight font values, and eight size values—all subject, of course, to the limitations of your hardware.

For compatibility with a wider range of third-party software, you can now save graphics images in either .CGM (graphic metafile) or .PIC (standard 1-2-3) format. Use /Worksheet Global Default Graph to set the default file type, or just supply the extension of your choice when you save.

There are several new conveniences under /Graph. For instance, press F10 from anywhere in the /Graph menu tree and you'll immediately see the effect of a customizing change without having to wander back up the tree to use the View command.

You can even press F10 from the worksheet without having first defined any data ranges. Release 3 refers to this as "automatic graphing." For example, if your cell pointer is located in a block of graphable data and all the graphing data ranges are clear (that is, you've just used the menu sequence /Graph Reset Graph or you're working in a file with no defined graphs), 1-2-3 responds to F10 by plotting whatever lies around the cell pointer. It draws each column as a separate data series (unless you change the default to rowwise using /Worksheet Global Default Graph Rowwise), and it uses an adjacent column of labels as category text.

Obviously, automatic graphing works fine under some circumstances and not so fine under others. You'll need to experiment to get a feel for what it can do. (You can read the details in the Reference manual to learn how Release 3 makes its "automatic" decisions, but going to that kind of trouble sort of defeats the purpose of this feature.)

/Graph Group lets you assign two or more data series as a single block. As with automatic graphing, 1-2-3 charts by col-

umns or by rows, depending on how you've set /Worksheet Global Default Graph.

/Worksheet Window Graph divides the screen into windows vertically, giving the right side over to the current graph, as seen in Figure 4. As with ordinary worksheet windowing, you control the width of this graph window by the position of your cell pointer when you use /WWG. (This feature does not work on some display adapters.)

Finally, with Release 3 you can print graphs without leaving the program and calling PrintGraph. (See last issue's Spreadsheets column for more information on printing.)

NEW WORKSHEET FUNCTIONS

The function library has been modestly expanded, so let's review it briefly:

■ **@COORD(worksheet,column,row,absolute)** creates a cell address from its arguments.

■ **@DGET(input,field,criteria)** extracts a value from a database table. The criteria argument must be a valid criteria range, but the field argument—in this as well as all other database functions—can be either a column offset or a field name enclosed in quotes. The @DGET arguments must generate a single unique value or else the function returns ERR.

■ **@DQUERY** sends a command to an external database management program, provided you have installed a driver for that program. (See the discussion on connecting to external databases, above.)

■ **@DSTS, @DVARs, @STDS, and @VARs** calculate sample standard deviations and variances. Previous versions of 1-2-3 offered only the population functions.

■ **@D360(start_date,end_date)** returns the number of days elapsed between its arguments, based on an artificial year of 12 30-day months.

■ **@INFO(attribute)** returns one of the following: the current directory, the current mode, the number of files in memory, the cell-pointer location at the start of a 1-2-3 session, the current recalc mode, the amount of memory now available, the total amount of memory available to 1-2-3 (including memory in use), the name of the operating system, the version number of the operating system, the return code generated by the most recent operating system command made during the current 1-2-3 session, or the release number of the 1-2-3 product being used.

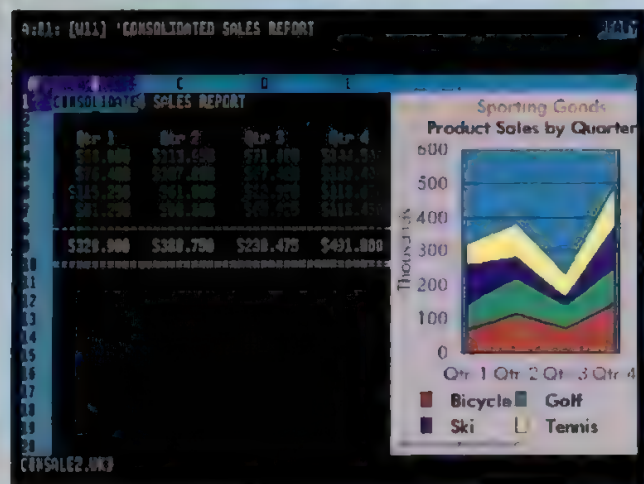


Figure 4: /Worksheet Window Graph lets you split the screen vertically and display the current graph on the right side. Only one graph at a time can be displayed this way.

Spreadsheets

■ **@ISRange(string)** returns a 1 if its argument is a defined range name and a 0 if it is not.

■ **@SHEETS(range)** returns the number of worksheets encompassed by its argument.

■ **@SUMPRODUCT(list)** takes as its argument two or more ranges of equal size and shape. The function multiplies together the first value in each range, the second value in each range, and so on—then returns the total of the products.

■ **@TODAY** returns **@INT(@NOW)**. The function has been reinstated in Release 3, after having been dropped from Release 2.

■ **@VDB(cost,salvage,life,start_period,end_period,[depreciation_factor][switch])** lets you fine-tune a double-declining-balance depreciation schedule and make the schedule switch to straight line when the straight-line calculation becomes greater than the declining-balance calculation.

FORMATTING OPTIONS

Release 3 offers several handy new options on both the /Worksheet Global Format and /Range Format menus. One of them, automatic formatting, has the potential to change significantly the way you enter data in 1-2-3. With automatic formatting in effect, if you enter a value that mimics a date, time, currency, percent, fixed, or scientific format, 1-2-3 displays the value in that format.

For example, if you enter 11/16/89, you no longer get .0077247191; if you enter 4:15 PM, you get the appropriate time value formatted as D7 (T2). If you enter \$1,000,000.00, you get C2 format—and so on.

Perhaps best of all, if you start with a number and follow with text (as in "123 North Elm Street"), you get a label. And if you enter an invalid formula, you also get a label (as you do in some other spreadsheet programs).

Two caveats apply to the use of automatic formatting. First, if you want a number less than 1,000 to be recognized as a comma format, you have to enter one or more leading zeros and a comma. Second, if you change the currency symbol to a multiple-character or multibyte value that appears before the number, automatic formatting no longer works with currency en-

tries. (The one exception to this is the U.S. dollar symbol followed by a space character; this combination is still recognized.)

Other new formatting options include the ability to have all entries treated as labels, to have negative values appear in red

**With Lotus 1-2-3,
Release 3, you can
squeeze up to 512
characters into
one cell entry—that's
twice the number
allowed in
earlier versions.**

(or high intensity), to have all values—positive or negative—enclosed in parentheses, and to have a label of your choice substituted automatically for any entries that evaluate to zero.

OTHER EVERYDAY CONVENIENCES

Release 3 also offers a few other conveniences to simplify data entry and editing, worksheet reorganization, and error handling. Cell entries can now hold up to 512 characters—twice as many as in earlier versions. And when you edit a long entry, the control panel expands downward; you no longer have to put up with horizontal scrolling.

You can enter function names from a list instead of typing them. Press @ followed by F3 to get a horizontal list; press F3 a second time to make the list full-screen. Unfortunately, you still have to remember the function syntax. You can also use this technique with macro keywords. Type { followed by F3 to get a list of available verbs.

There is no longer any need to create date column headings by hand or macro; you can use /Data Fill instead. To specify a step value in days, type an integer followed by a d; to specify a skip in months, follow the number with an m, and so on. The step value unit can be seconds, minutes, hours, days, weeks, months, quarters, or years.

Formulas and range names can now be annotated. To add a comment to a formula, follow it with a semicolon and the comment. To annotate a range name, use /Range Name Note Create, select the range name from the ensuing list, and type your comment. You can use /Range Name Note Table to generate a three-column list of range names, their addresses, and their descriptive comments.

A formula that references an undefined range now returns ERR. This gives you more flexibility in the way you work; you can resolve the references later. You can reference nonexistent filenames as well as undefined ranges. To specify a nonexistent file, type double opening and closing angle brackets (<<>>) with nothing in between. These references, of course, also return ERR.

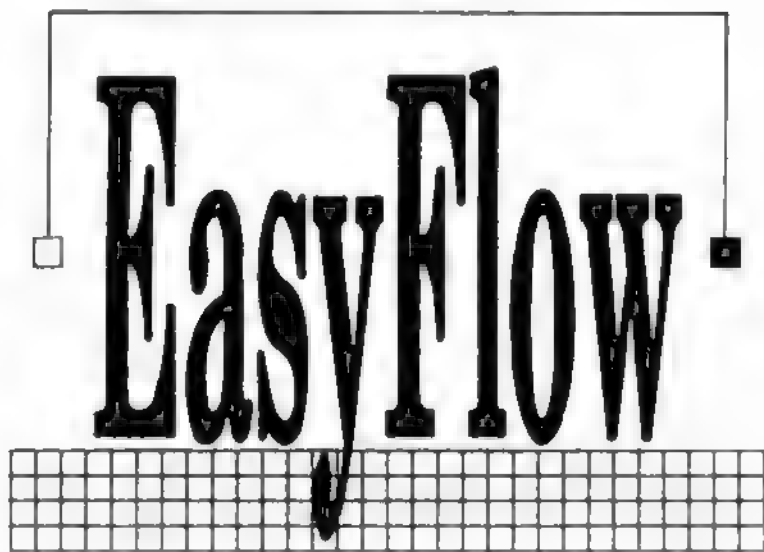
Named references now remain on the edit line when you press F2. Earlier versions substituted the original cell addresses for the names when you went to edit a formula. Release 3 does not, however, automatically substitute names for cell addresses in formulas entered after the cell addresses have been defined. For example, if you define C10..N10 as TOTALS, all existing references to C10..N10 are changed to TOTALS, but all subsequent references to that range are not changed. The program assumes that if you reference an already named range by its cell addresses, you know what you're doing. (But you can apply the name later if you change your mind; just go into EDIT mode, put the cursor on the reference, and press F3.)

If you delete one of the end-point cells of a range, 1-2-3 now contracts the range and adjusts all formulas appropriately. Earlier versions convert work to mush under these circumstances. (If you use /Move to overwrite a range end point, however, the range still becomes undefined—as it does in previous versions.)

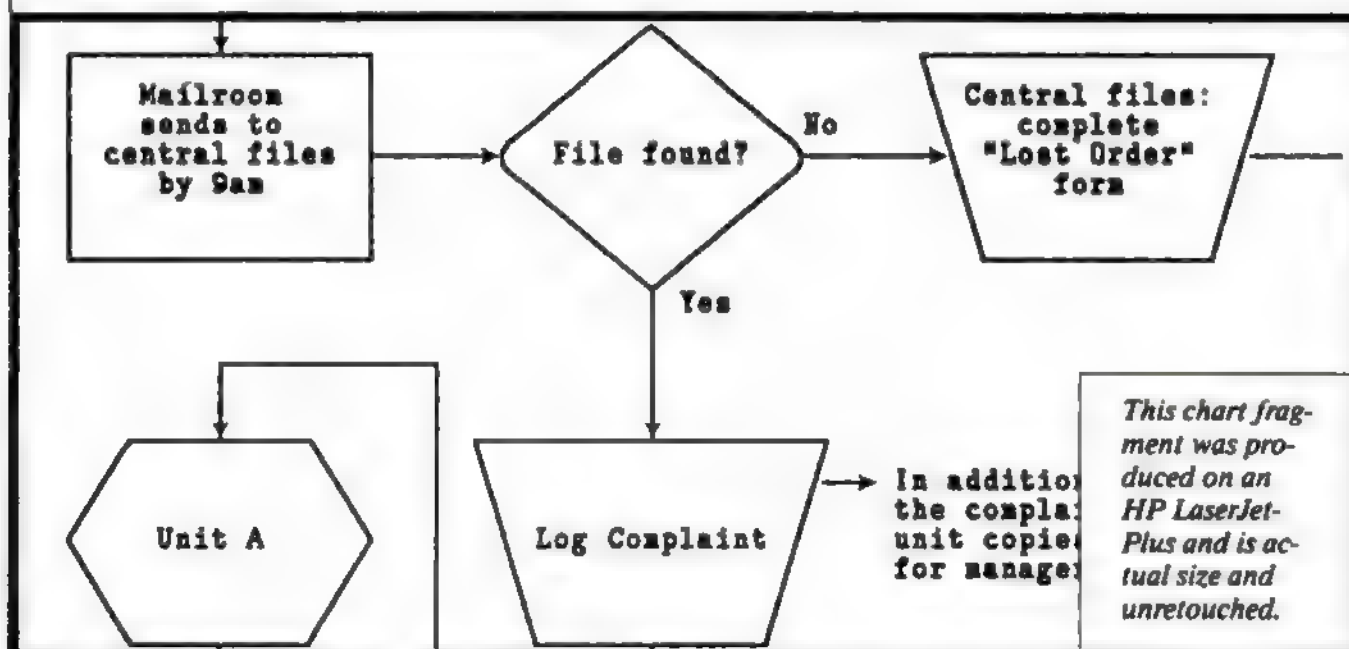
Finally, 1-2-3 is now a little friendlier in its handling of command errors. Instead of bouncing you out to the worksheet when you clear the error indicator, it now leaves you in EDIT mode and gives you a chance to make amends.

IS AN UPGRADE IN YOUR FUTURE?

Now for the \$64,000 question: Should you upgrade? The answer, of course, is—it depends. Provided the hardware requirement is not insuperable, I'd seriously consider it if I needed the convenience of doing consolidations via 3-D worksheets or if I required a tool for analyzing large external



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Spreadsheets

data files. Both *Excel* and *Quattro Pro* are also a lot more adept at worksheet consolidation than Release 2.x, but neither of those programs offers multipage 3-D. And in spite of everything Borland has done to ensure Lotus compatibility, I think the user with deeply ingrained 1-2-3 habits will find a transition to Release 3 a marginally lower learning hurdle than a transition to *Quattro Pro*.

However, if your main concern is generating boardroom presentations, you should stay away from Release 3—at least

Should you upgrade?
If you need a tool for
analyzing large
external files, the
answer might be yes.

until Lotus gets *Allways* into the picture. While you're waiting, take a good hard look at *Excel* and *Quattro Pro*, both of which paint circles around 1-2-3, with or without *Allways*. (You might also want to check out 1-2-3/G, which ought to be available by midyear.)

And if you're already using a suite of Release 2 add-ins, you may lose more than you gain by moving to Release 3, since those add-ins won't run. Presumably the most successful Release 2 add-ins will appear in Release 3 versions before long and vendors will offer inexpensive upgrade options. But if you're an add-in junkie there's no reason to move until they do.

SEND US YOUR HINTS, TIPS, AND QUESTIONS

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by
Neil J. Rubenking

User-to-User

NOTHING DOING

I have written a small device driver called DUMMY.SYS (an arbitrary name). Like all such beasts, it gets loaded from a DEVICE= statement in the CONFIG.SYS file. In operation it is extremely simple: it does nothing. That is, when loaded it merely informs DOS that it is a legitimate device properly installed, and then it removes itself from memory. Hence it adds no overhead to the computer's operations. Although it performs no function, it is useful in at least two cases.

The first involves the installation programs that come with various commercial software packages. Some of these programs read the CONFIG.SYS file and will not complete the installation unless they find a DEVICE= statement for some specific driver. There are times when you cannot load that specific driver but want to install your software anyway. In that case, rename DUMMY.SYS to the name of the missing driver, load it, and run your installation routine. As long as neither you nor the program tries to access the nonexistent device, you are in business.

DUMMY.SYS is also useful in conjunction with Michael J. Mefford's CONFIG.CTL program (see the November 29, 1988, Utilities column), which allows you to modify your system configuration at boot-up. Mr. Mefford points out that using this program automatically generates error messages during the start-up routine. This occurs when DOS tries to load nonexistent device drivers specified in the DEVICE= statements. CONFIG.CTL requires at least one such statement to run: DEVICE=CONFIG.END. You may require more if you want to reserve place-saver DEVICES and specify them later from CONFIG.CTL.

Although these error messages are harmless, I'm sure it rankles some people to have known bugs in their systems, no matter how benign they may be. Moreover, there is no guarantee that future versions of DOS will accommodate them so easily. Already OS/2 requires a "Press any key" response when it encounters errors in the

■ **NOTHING DOING: A device driver that does nothing can prove surprisingly useful.**

■ **AUTOMATING BACKUPS: Here's a useful batch program that uses XCOPY to do backups.**

CONFIG.SYS file. I have run across other quirks while using CONFIG.CTL with DOS 4.0. In any event, now you can reserve blank DEVICES with multiple DEVICE=DUMMY.SYS statements that will generate no errors. You can also name a copy of DUMMY.SYS CONFIG.END.

CONFIG.CTL converts the error message generated by a CONFIG.END line to a less severe "Unknown command." However, now that DUMMY.SYS (in the guise

of CONFIG.END) can be loaded, there is no need for this ruse. To patch CONFIG.CTL so that it does away with the "Unknown command" message, enter this sequence from the command line:

```
DEBUG CONFIG.CTL
-E 4A5 44
-W
  (Writing 68C bytes)
-Q
```

Now CONFIG.CTL will behave quite nicely.

Jeffrey J. Hamilton
Jessup, Maryland



To create DUMMY.SYS, type in DUMMY.SCR (Figure 1) using any editor that can produce flat ASCII files. As usual, blank lines are important—don't omit the line before RCX and the one after the final Q. After you've finished creating the file, give the command DEBUG < DUMMY.SCR in order

DUMMY.SCR

COMPLETE LISTING

```
N DUMMY.SYS
E 100 FF FF FF FF 00 80 16 00 21 00
E 10A 20 20 20 20 20 20 20 20 00 00 00
A 116
CS:
MOV [0012],BX
CS:
MOV [0014],ES
RETF
PUSH DS
PUSH DI
PUSH CS
POP DS
LES DI,[0012]
ES:
MOV WORD PTR [DI+03],0100
ES:
MOV WORD PTR [DI+0E],0000
ES:
MOV [DI+10],CS
POP DI
POP DS
RETF

RCX
3C
W
Q
```



Figure 1: This dummy device driver can be useful as a placeholder in your CONFIG.SYS file. It allows you to use CONFIG.CTL without seeing error messages.

User-to-User

to produce DUMMY.SYS.

DUMMY.SYS is about the smallest device driver you could write. It gets called only once. When DOS loads a device driver from CONFIG.SYS, it calls that driver's Init function. The Init function sets up the device driver and tells DOS how much memory to reserve for it.

DUMMY.SYS does no setting up—it just returns a "done" code. And it tells DOS to reserve *no* memory for it. You can check: run a memory mapper with and without DUMMY.SYS and you'll see no change. Note that DUMMY.SYS will not work with DOS versions earlier than 3.0.

Be careful patching CONFIG.CTL. There are at least two versions: the original and a modified version available on PC MagNet. Once you have CONFIG.CTL loaded in DEBUG, give the command U 4A3 L 3. If you see MOV BYTE PTR [BX],5A, you have the right version. Otherwise, try U 503 L 3. If this second test gives the correct result, substitute 505 for 4A5 in the patch described above. And of course, if neither location gives the correct result, *don't* patch the program.

AUTOMATING BACKUPS

I find the XCOPY command to be a very useful backup utility. Like BACKUP, XCOPY uses the archive bit to identify files that are new or changed since the last backup. Unlike BACKUP, however, XCOPY does not require a special restoring program to recover the files; they are stored in their original format.

The batch program BU.BAT (Figure 2) implements backing up with XCOPY. It includes provisions for identifying the backup diskettes, as well as custom procedures to prevent the backup of temporary files.

BU backs up specific directories one level below the root directory. It puts the files of each directory (with its subdirectories) on separate diskette sets. The syntax for using BU.BAT is

BU directory option [/p/d:date]

where *directory* is a directory name and *option* is one of the characters a, c, e, or m.

Assume, for example, that you wish to archive the files in the C:\WRK directory and its subdirectories. First, place a blank diskette in the A: drive and type the com-

mand BU WRK C. This command marks the disk with an identifying file WRK.DIR. The identifying file must match the directory to be backed up. Then type BU WRK M. All the files that have their archive bit set will be copied onto the backup diskettes, and the archive bit will be reset following the copy. If the amount of data exceeds the storage capacity of the diskette, you'll receive an "Insufficient disk space" error message. If you do receive this message, just replace this disk with a blank one and then repeat the

two previous commands.

When you create a new file or edit an existing one, the file's archive bit is set. You can issue the command BU WRK M to copy the new files to your last backup disk. As this disk fills up with new files, just keep adding disks and save the old ones as archives of your previous work.

BU also permits you to back up files without resetting the archive bit (the a option). This is useful if you wish to create two backup copies of each file. First issue the

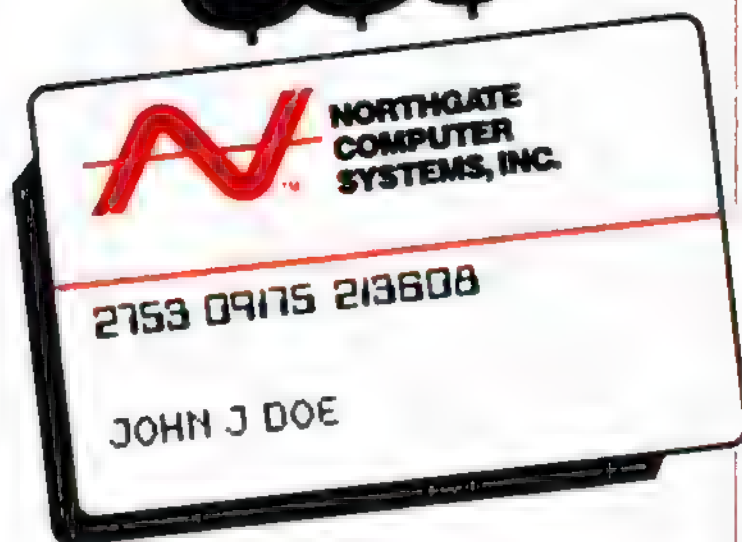


Figure 2: BU.BAT makes it easy to use XCOPY for backing up files.

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Requested Line of Credit \$

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Previous Address:		Dates of Residence: From To		Monthly Income: Gross \$ Net \$			
Your Employer: (If self-employed, see rear panel)		Date of Employment: Mo Yr		Position:			
Employer's Address: Street		City	State	Business Phone: ()			
Previous Employer:		Address:		Dates of Employment: From To			
Income from authority child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation		Other Income: I have received since (Date)		Monthly Income: Gross \$ Net \$			
Name and Address of Nearest Relative Not Living With You							

b. Credit Information

Include joint applicant's information if joint account requested

Bank Account:	Bank Name	Address	☐ Checking ☐ Savings
Bank Account:			☐ Checking ☐ Savings
Bank Loan Reference:			Payment Balance
Bank Card Reference:	YES	Mastercard	
Other Credit Card Reference:			
Other Credit References:	Account No.	Expires	
Driver's License No.	State	Expires	

c. Joint Applicant's Personal Information

If you are a married Wisconsin applicant, you must provide your spouse's information below even though your spouse may not be signing this contract

Joint Applicant's Name: First		Initial	Last	Date of Birth: Mo Day Yr		Social Security Number:	
Address: Street		Apt #	City	State	Zip	Home Phone: ()	
Employer:		Date of Employment: Mo Yr		Position:		Monthly Income: Gross \$ Net \$	
Employer's Address: Street		City	State	Business Phone: ()			

d. Self-Employed Information

Business Name	Proprietorship	Corporation	Partnership
Business Address	Business Telephone		
When did you start business?	Your business since		
Your annual income from business	Business annual income (gross)	(net)	
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User-to-User

BU command with the a option and then issue the BU command with the m option.

In addition, you can back up the entire subdirectory structure (e option), prompt (/p option) the copying of individual files, or back up all the files created on or following a particular date (/d option). All except the c option are derived from the options for XCOPY. Additional information on using the XCOPY command can be obtained from your DOS manual.

You must include references to all the directories you wish to back up in the parameter list of the FOR statements that follow lines beginning with the label :ADD. Every directory must appear in one of the first two such statements, and any that require customized backup procedures should also appear in the third. In the example, when you select the dos or wrk directories, custom lines in BU zero the archive bit of certain files to make sure they will not get backed up. In addition, I use SWEEP.COM to delete temporary *.BAK files.

David Hary
Sun Valley, California



You can get SWEEP.COM by downloading it from PC MagNet. SWEEP performs whatever command you give it in the current directory and all of its subdirectories. In BU.BAT, SWEEP deletes all *.BAK files so they won't get backed up to diskettes.

I use XCOPY for backing up directories, too. XCOPY can't split files across disks, so it's no good for backing up files that won't fit on a single disk. And it can waste disk space. Suppose the current backup disk has 290K free and the next file is 300K. XCOPY will report that the disk is full, though it could accommodate 290K

of smaller files. But the fact that the backed-up files are available in ordinary DOS format more than makes up for these minor problems.

Do note that every time you change a file in any way, the archive bit gets set and the next backup stores a new copy of that file. As a result, you'll have an "audit trail" of the changes made to that file. When you restore individual files, be careful to restore the *most recent* backup. And when you restore all files, start with your oldest backup disk. That way the newer files will get copied over their older versions.

At times you may want to start fresh with a new full backup of a given directory. It's easy to do this—just make that directory current and give the command

```
ATTRIB +A *.* /S
```

This sets the archive bit of every file in the directory and in all of its subdirectories. Either store your old set of backup disks or reuse them.

To avoid wasting a cluster of space on the backup diskette, you can change the identifying file (such as WRK.DIR) to a 0-byte file. Just replace the line

```
ECHO %1.DIR> A:\%1.DIR
```

with

```
REM > A:\%1.DIR
```

Now the marker file takes *no* clusters of disk space—it occupies only a single directory entry.

My own XCOPY batch file in Figure 3 is much simpler than BU.BAT, but it has one virtue that BU doesn't. When XCOPY reports a "Disk full" error, it sets a non-zero ERRORLEVEL. My batch file checks the ERRORLEVEL and automatically prompts for more diskettes until the job is done. You may want to modify BU.BAT to loop in a similar fashion.

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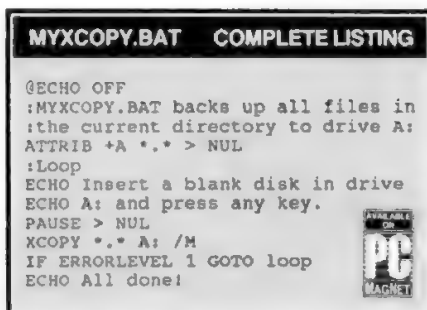


Figure 3: MYXCOPY.BAT isn't as sophisticated as BU.BAT, but it uses ERRORLEVEL to keep looping until all files are copied.

by
Jeff Proise

Tutor

MODIFYING CHARACTER SETS

Can characters displayed on the screen in text mode be changed? ASCII 218, for example, corresponds to the upper-left corner of a single-line box. Can it be programmed to appear as something else?

Martin Weisman
Newark, New Jersey



It can if you have an EGA or VGA video adapter. Unlike IBM's original color and monochrome video adapters, the CGA and the MDA, which store character bitmaps in ROM where they can't be altered, the EGA and the VGA store them in RAM. By modifying the character bitmaps, you can change the way individual characters appear on the screen—even in text mode.

The video BIOS provides a set of functions for dealing with text-mode characters. The code fragment in Figure 1 uses the BIOS to transform the character whose ASCII code is 218 into a Greek character, delta. It works as is on VGA video adapters and with slight modifications on EGAs.

The 16 bytes of data labeled CharDef in the code listing define the new character's appearance. If you look closely, you will notice that the pattern of 1's forms the shape of a triangle. Every 1 will show up as a foreground pixel on the screen, and every 0 will be painted with the background color. Following the character definition is the code that effects the change. A simple call to interrupt 10h function 11h writes the new character bitmap to the default character table in adapter memory. Once the character map is updated, any characters with ASCII code 218 displayed on the screen will automatically change.

Of course, there are better ways to craft custom character sets than by juggling 1's and 0's in assembly language code listings. Michael Mefford's FONTEDIT utility, which appeared in the September 13, 1988, Utilities column, allows you to create new characters from scratch or modify existing ones with the aid of an oversized

■ MODIFYING CHARACTER SETS: Change the characters associated with ASCII codes.

grid. If your work involves changing more than one or two characters, use an interactive font-editing tool like this one to reduce the amount of labor involved.

It takes 16 bytes to define a character on the VGA because the VGA displays characters in a 9 by 16 character matrix. An EGA uses only 14 scan lines per character, requiring only 14 bytes rather than 16 for

character definitions. You can modify the sample code shown in Figure 1 for an EGA by eliminating the last two rows in the CharDef array and changing the instruction from MOV BX,1000h to MOV BX,0E00h. BH specifies the number of bytes per character; in this case, we're reducing it from 16 (10h) for the VGA to 14 (0Eh) for the EGA.

Character bitmaps are only 8 pixels—1 byte—wide. Yet EGAs connected to monochrome monitors display characters in 9 by 14 grids and VGAs display characters in 9 by 16 grids. Where do the extra pixels come from? For most characters, the ninth pixel in each row is simply left blank, enabling you to use the full width of the 8-bit matrix without having to leave

HOW TO CHANGE A VGA TEXT-MODE CHARACTER BITMAP

```
;Character bitmap (16 bytes for a VGA, which displays
;characters in a 9 by 16 matrix).
;
CharDef db 00000000b ;Row 1 (blank)
         db 00000000b ;Row 2 (blank)
         db 00010000b ;Row 3
         db 00111000b ;Row 4
         db 00101000b ;Row 5
         db 01101100b ;Row 6
         db 01001000b ;Row 7
         db 01001000b ;Row 8
         db 11000110b ;Row 9
         db 10000010b ;Row 10
         db 10000010b ;Row 11
         db 11111100b ;Row 12
         db 00000000b ;Row 13 (blank)
         db 00000000b ;Row 14 (blank)
         db 00000000b ;Row 15 (blank)
         db 00000000b ;Row 16 (blank)
;
;Code to redefine one character in character table 0.
;
NewChar proc far
         mov ax,1100h ;Function/subfunction
         mov bx,1000h ;16 bytes per char,
                       ; write to table 0
         mov cx,1 ;One char to write
         mov dx,0DAh ;ASCII code
         push cs ;Point ES:BP to bitmap
         pop es
         mov bp,offset CharDef
         int 10h ;Load the bitmap
         ret
NewChar endp
```

Figure 1: Function 11h in the EGA and VGA video BIOS can be used to change the appearance of characters displayed on the screen in text mode. Here, the character whose ASCII code is DAh (218 decimal) is transformed into the Greek character delta. If you look closely at the CharDef array, you'll see the shape of the new character outlined in 1's.



EGA AND VGA CHARACTER TABLES: STORAGE FOR CHARACTER BITMAPS

STRUCTURE OF EGA CHARACTER-GENERATOR RAM

E000h (56K)	Unused
C000h (48K)	Character Table 3
A000h (40K)	Unused
8000h (32K)	Character Table 2
6000h (24K)	Unused
4000h (16K)	Character Table 1
2000h (8K)	Unused
0000h	Character Table 0

STRUCTURE OF VGA CHARACTER-GENERATOR RAM

E000h (56K)	Character Table 7
C000h (48K)	Character Table 3
A000h (40K)	Character Table 6
8000h (32K)	Character Table 2
6000h (24K)	Character Table 5
4000h (16K)	Character Table 1
2000h (8K)	Character Table 4
0000h	Character Table 0

Figure 2: Each table is 8K in length, providing 32 bytes for each of 256 characters. On the VGA, up to eight character tables can be defined; the EGA allows only four. VGA character tables are aligned on 8K boundaries, while EGA character tables are located at 16K intervals with an 8K gap between each one. Offsets are shown relative to the base of map 2.

one column of pixels blank to provide separation between adjacent characters. But for character codes C0h through DFh, foreground pixels located in the eighth column are replicated in the ninth. This allows text-mode line-drawing characters to join together to form unbroken lines. If you redefine a character in this range, be sure to leave pixels in the last column blank unless you want them to appear in the ninth column as well. You can optionally disable the bit-replication feature by clearing bit 2 of the EGA or VGA adapter's Attribute Mode Control Register, accessed through the Attribute Controller at port address 3C0h.

Video memory on EGAs and VGAs is divided into four parallel bit planes called *maps*. In text modes, map 0 holds the ASCII codes that define what characters are displayed on the screen; map 1 holds the attributes that accompany the character codes; and map 2 holds the character bitmaps that define how each ASCII code is displayed. To maintain compatibility with programs that expect the logical organization of the video buffer to be the same as that of the CGA and MDA, where even-numbered bytes hold character codes and odd-numbered bytes hold attributes, the CRT Controller translates addresses in

map 0 to even addresses in the CPU's video segment and addresses in map 1 to odd addresses in the video segment. As a result, character-mode programs that write directly to video memory on CGAs and MDAs work unblemished on EGAs and VGAs, even though the physical makeup of adapter memory is quite different.

Groups of 256-character bitmaps that define an entire character set are stored together in structures known as character tables. One character table is 8K in length. The EGA and VGA character generators consult the character tables to determine what pixels to light to display a given character. The VGA permits up to eight tables to reside in memory at once; the EGA permits four. Figure 2 shows how character tables are arranged in map 2 on both adapters. EGA character tables are aligned on 16K boundaries, with an 8K gap between each two. Tables are contiguous on the VGA, located at offset addresses that are multiples of 8K within the physical segment that map 2 is mapped to.

The 8K length of a single character table divided by 256 means that there are 32 bytes set aside for each character, so any one character can be up to 32 scan lines high. Typically, less than the full 32 are used. On a VGA running in 25-line text

mode, for example, each character uses 16 scan lines. An EGA in 25-line text mode uses 14. Regardless of how many bytes are needed to define a single character, character bitmaps always begin on even 32-byte boundaries. For good form, the unused bytes at the end of each character are usually zeroed out.

The contents of the sequencer's Character Map Select Register determine which of the eight VGA or four EGA character tables the character generator goes to for display data. By default, at power-up or after a BIOS mode set is initiated, table 0 is used. If you need to switch between character sets, you can do so by setting bit 1 of the Memory Mode Register and writing table select values to Character Map Select—or you can use a built-in BIOS function that takes care of both at once (more on this later). When the EGA was first introduced in 1984, IBM showed a stunning demonstration of EGA character-mode graphics that used the adapter's ability to switch between downloaded character sets to give you the feeling that you were watching a graphics-mode animation sequence. Few if any software packages have taken such measurable advantage of the EGA's programmable character-generator hardware since.

Accessing a character table to modify character bitmaps or load a completely new font involves manipulating several EGA or VGA hardware registers in sequence to map character-table RAM to segment A000h in the CPU address space. After the bitmaps are altered, the registers must be rewritten to restore the adapter to its normal mode of operation. Without routines built into the video BIOS, this would be a complex process. But the BIOS makes it easy. By utilizing interrupt 10h function 11h, you can bypass the nuances of the hardware altogether and deal with the video adapter on a level that is at once much higher and more likely to be compatible with future adapters.

Figure 3 summarizes the subfunctions that make up the video BIOS's function 11h text-mode character-generator programming interface.

Two sets of subfunctions—subfunctions 00h, 01h, 02h, and 04h and subfunctions 10h, 11h, 12h, and 14h—permit you to load custom character sets into the RAM-based character tables. You can load all or part of a set. BL specifies the number of the character table (0 through 7 on VGAs, 0 through 3 on EGAs) into which the bitmap information is copied.

CX specifies the number of sequential character bitmaps you're loading, and DX holds the ASCII code (actually an index into the character table) of the first character affected. If you like, use alternative character sets already included in video-adaptor ROM. The EGA provides two: the default 8 by 14 character set (used in 25-line text modes) and an 8 by 8 character set typically used in 35- or 43-line modes. The VGA provides three: the default 8 by 16, 8 by 8, and the EGA's 8 by 14.

On the surface, it may appear that these two sets of services are redundant: each subfunction in the first set has a direct counterpart in the second. The distinction is that members of the first set simply copy the specified font to the designated character table. The second set does the same but also reprograms the CRT Controller to adjust for the vertical size of the new font. The difference: if you load an 8 by 8 font with subfunction 02h, the display will remain in 25-line mode, leaving an inordinate amount of space (still filled with the lower half of the old character set) between the bottom of one row and the top of the next. If you load the same font with subfunction 12h, the BIOS will automatically adjust the number of lines on the screen to accommodate the smaller screen font. Charles Petzold's EGA43.COM utility, which appeared in the September 16, 1986, Programming/Utilities column, uses this subfunction to program the EGA to display 43 lines of text.

Once several character sets are loaded into the RAM-based character tables, subfunction 03h can be used to switch between them. The BIOS takes care of the hard part: initializing the Memory Mode and Character Map Select Registers. The bad news is that the value passed in BL is not a simple table number. On a VGA, BL (whose contents are written to the Character Map Select Register) must contain 00h to select character table 0, 05h for table 1, 0Ah for table 2, 0Fh for table 3, 30h for table 4, 35h for table 5, 3Ah for table 6, or 3Fh for table 7. The values are the same for an EGA, but only tables 0, 1, 2, and 3 may be selected. If it sounds confusing, it is. Writing other values to Character Map Select can result in some pretty strange stuff. Adhere to these simple rules and the process will remain relatively straightforward.



THE VIDEO BIOS CHARACTER-GENERATOR PROGRAMMING INTERFACE

FUNCTION 00h: Load custom font

Call with: AH = 11h
AL = 00h
BH = Bytes per character
BL = Character table number
CX = Number of characters to define
DX = ASCII code of first character defined
ES:BP = Address of custom character table

FUNCTION 01h: Load BIOS 8 by 14 font

Call with: AH = 11h
AL = 01h
BL = Character table number

FUNCTION 02h: Load BIOS 8 by 8 font

Call with: AH = 11h
AL = 02h
BL = Character table number

FUNCTION 03h: Select character table

Call with: AH = 11h
AL = 03h
BL = Value for Character Map Select Register

FUNCTION 04h: Load BIOS 8 by 16 font

Call with: AH = 11h
AL = 04h
BL = Character table number

FUNCTION 10h: Load custom font and program the CRTC

Call with: AH = 11h
AL = 10h
BH = Bytes per character
BL = Character table number
CX = Number of characters to define
DX = ASCII code of first character defined
ES:BP = Address of custom character table

FUNCTION 11h: Load BIOS 8 by 14 font and program the CRTC

Call with: AH = 11h
AL = 11h
BL = Character table number

FUNCTION 12h: Load BIOS 8 by 8 font and program the CRTC

Call with: AH = 11h
AL = 12h
BL = Character table number

FUNCTION 14h: Load BIOS 8 by 16 font and program the CRTC

Call with: AH = 11h
AL = 14h
BL = Character table number

FUNCTION 30h: Get character generator information

Call with: AH = 11h
AL = 30h
BH = 0 Return interrupt 1Fh vector
= 1 Return interrupt 43h vector
= 2 Return address of BIOS 8 by 14 character table
= 3 Return address of BIOS 8 by 8 character table
= 4 Return address of second half of BIOS 8 by 8 character table
= 5 Return address of BIOS 9 by 14 alternate character table
= 6 Return address of BIOS 8 by 16 character table
= 7 Return address of BIOS 9 by 16 alternate character table
Returns with: CX = Bytes per character
DL = Number of displayed rows of text
ES:BP = Requested address

Figure 3: Interrupt 10h function 11h is the video BIOS's interface to the character generator.

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Tutor

The final character-generator service, subfunction 30h, is used to obtain information about character sets and current video parameters. The value it returns in CX is the number of scan lines per character in the currently displayed screen font, also known as the number of points. DL returns the number of rows of text displayed, minus 1, while ES:BP returns the address of the designated font. Why would you want the address of a character set? If you want to tweak a character, you'll need to know what it looks like first. Without the BIOS, you'd simply go straight to the corresponding character table and read the bitmap. But you can't get to the character table through the BIOS because the BIOS shields you from it. The alternative is a more indirect method: read the bitmap from ROM (using the address the BIOS gives you), modify it, then write it to the character table using subfunction 00h.

Though the code listing in Figure 1 is written in assembly language, you could work in any high-level language that provides a mechanism for triggering software interrupts (C's `int86()` and `int86x()` functions, for example) if it weren't for one problem: the BIOS's use of ES:BP to pass far addresses. Most compilers—and certainly C compilers—require that the value of BP be preserved across function calls. This means that you can't use BP to pass or return a value. If you're writing in a high-level language and need one of the three subfunctions that uses BP, write a short assembly language routine to do the job. If your routines use subfunction 30h, which returns an offset address in BP, write the routine as a function and return BP as the value of the function. Or, pass the function the address of a far pointer that ES:BP can be stuffed into.

ASK THE TUTOR

The Tutor solves practical problems and explains points of general interest about using your hardware and software more productively, as well as answering basic questions about DOS and systems in general. To have your questions answered here, write to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column). We're sorry, but we cannot answer questions personally. ■

by
Frank J. Derfler, Jr.

Connectivity Clinic

BUILDING A NETWORK

We want to build a five-user network, but we're concerned about the cost and about file security. All files will be stored on one hard disk and we will share one printer. We are considering the following configurations: one 80386 running *PC-MOS/386* with four dumb terminals, five 8088 PCs connected via a zero-slot LAN, and five 8088 PCs connected via a low-cost LAN like *LANtastic*.

Will you comment on the advantages and disadvantages of these setups?

Orcun Kolcu

Istanbul, Turkey

PC If prices for different PCs have the same relationship in Turkey that they do in North America, you can buy three 8088-based PCs for the price of a 386 machine. When you add the cost of the terminals to the 80386 needed for the multitasking option you mention, the prices of these systems are close.

But if you use an 8088-based PC as a file server for the other machines, performance will be sluggish. Even if you upgrade one machine to an 80286-based PC with a fast hard disk, performance will suffer if you run five machines over a zero-slot LAN. And since networks have a tendency to grow, I don't recommend the zero-slot-LAN option.

If you can get a local dealer to help you set up *PC-MOS/386*, it will give you good service at a reasonable price. The diskless workstations enhance overall security because no one can walk away with a floppy disk full of data.

You can set up both *PC-MOS/386* and *LANtastic* to prevent unauthorized access to files, but you must provide physical security for the machine that is acting as a server, since the files are available to anyone with access to the server. If you can't upgrade at least one machine to an 80286 with a fast hard disk drive, then I'd recommend sharing a single 80386-based machine under a multiuser operating system like *PC-MOS/386*.

■ **BUILDING A NETWORK:**
Various options are available for creating a secure, low-cost network.

■ **IMPROVING NETWORK PERFORMANCE:**
Reformat your server's hard disk periodically for better results.

■ **A MINIMALIST APPROACH:** How to get 3270 terminal emulation in limited RAM space.

■ **EXPLORING THE TOKEN-RING HUB:**
Where is the ring in Token-Ring networks?

IMPROVING NETWORK PERFORMANCE

Slowdown of a server's performance is often due to file fragmentation on the server's hard disk. We find that print jobs particularly cause fragmentation.

We use IBM's *PC LAN* software with DOS 3.3. When the performance of our system starts to degrade (after about a month), we back up the server and use the DOS *FORMAT* command on the drive. Then we reload the network software from a backup copy and restore the files. This greatly improves network performance.

Lionel Grosset

Sergy, St.-Genis-Pouilly
France

PC Others can benefit from your experience. Reformatting a server's hard disk periodically is a good practice. Just be sure that your backup is good. Don't use a "disk image" backup. Although this type of backup is fast, when you restore the files, they will be exactly as they were before—fragmented. Instead,

you should restore the server's hard disk on a file-by-file basis.

A MINIMALIST APPROACH

We need an SNA 3270 gateway connection between our network and our IBM 3174 Terminal Cluster Controller, but all of the terminal emulators we've seen use too much workstation RAM. It doesn't do any good to load the emulation software as a TSR if you lose 200K of RAM. What is the smallest practical terminal-emulation software available right now?

Randolph A. Johnston

Chicago, Illinois

PC Most companies load as many features as possible, such as multiple sessions and flexible key mapping, into their terminal-emulator programs. Unfortunately, even the users who don't need all of these features pay the price in RAM. ICOT Corp. ((408) 433-3300) has a terminal emulator for its OmniPATH SNA Gateway that dispenses with many of the bells and whistles, such as multisession operation. As a result, it occupies only 40K of RAM. Of course, you'll lose some additional RAM to the networking software. This solution represents the smallest expense of RAM that we've found combined with full capabilities.

EXPLORING THE TOKEN-RING HUB

As a systems programmer, I often work late at night in an office with a large IBM Token-Ring system installed. My desk is near the wire room where all the cables for the network come together. Whenever the office is quiet, I hear clicking sounds coming from the hubs in the cable room. One maintenance man says this is static discharge from the cable. I doubt that, but I don't know what it is. And by the way, if the network is a ring, why do all the cables come together in one place? Why don't they run from desk to desk in a ring?

Jillian Swans

San Francisco, California

Connectivity Clinic



The answers to your questions about the clicking sounds and the configuration of the wiring all relate to the fact that the ring in token-ring is contained within the actual hub or hubs in the network.

As shown in Figure 1, the hub for a token-ring system contains relays. These are

good old electromagnetic relays like those that have been with us since before Henry Ford turned out the first Model T. When a node on a token-ring network activates its internal network adapter card, the card sends DC voltage over the cable to the relay in the hub. The relay pulls in with the click you hear. There is a softer click when the station shuts down and the relay disconnects it from the hub.

The relays in the token-ring hub disrupt the ring for a fraction of a second when

they attach or detach stations, but the software easily handles the disruption. Electrically, each station in the ring receives and relays each data packet, or token, so the data travels around in a true ring. Physically, however, the configuration is a small circle of relays in the hub with long extensions to the workstations.

The cables take a direct path to the hub primarily for the sake of reliability. In a desktop-to-desktop wiring scheme of the sort Ethernet uses, one bad connector can bring down the entire network. In a hub design, each cable run is independent. If the cable is cut or has a bad connection, it can be isolated at the hub either automatically or manually. Proteon has a hub that is more automated than IBM's, and Synoptics Communications should enter the token-ring market with fancy management

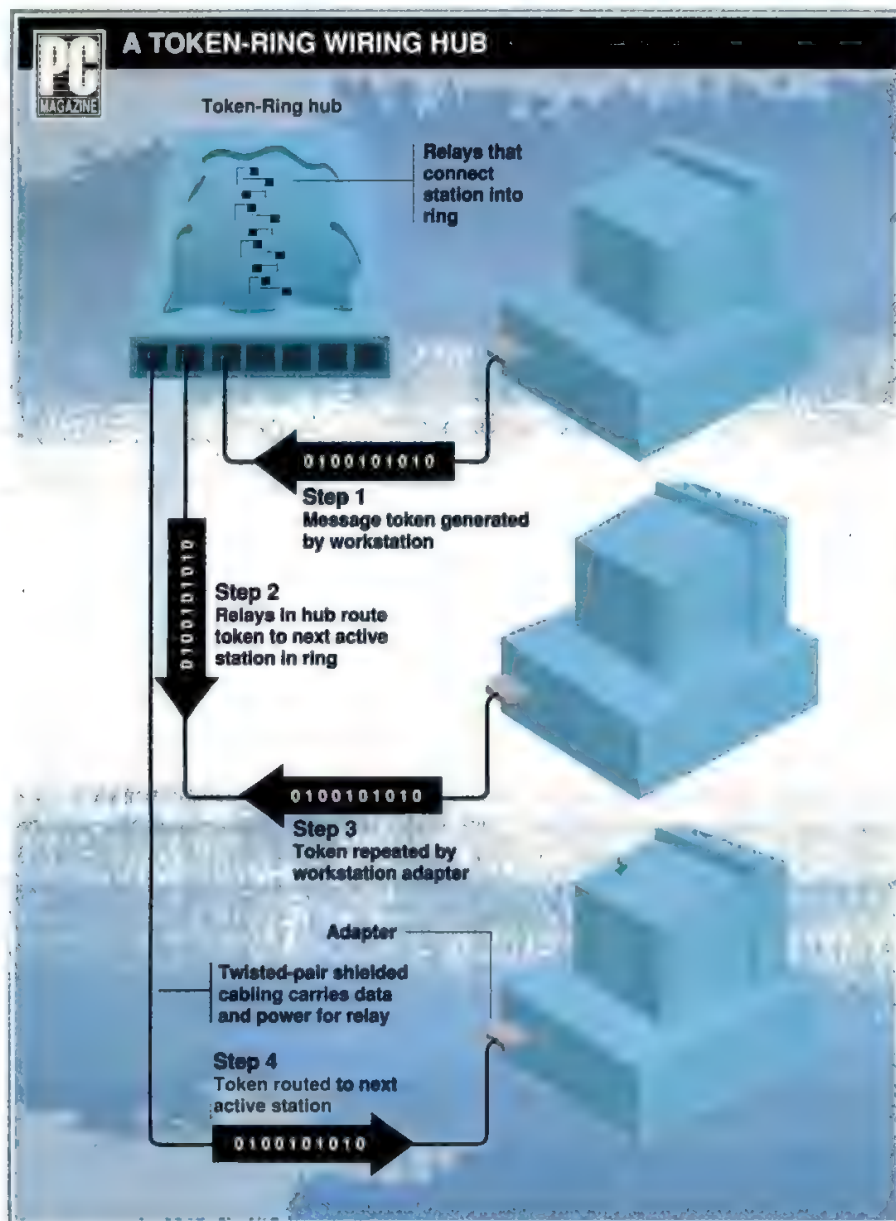


Figure 1: The network adapter cards in each token-ring node provide power to electromechanical relays in the Multistation Access Unit, or hub. Energized relays connect stations into the ring. A message token moves from a workstation through the relays in the hub and on to the next active node. Each node reads and relays the token. Only destination and origination nodes make changes to the token. This diagram is simplified for clarity. In actual systems, a long message token can pass through several nodes at the same time.

The clicks you hear
when you are alone late
at night are the hubs
reaching out to
connect to your node.

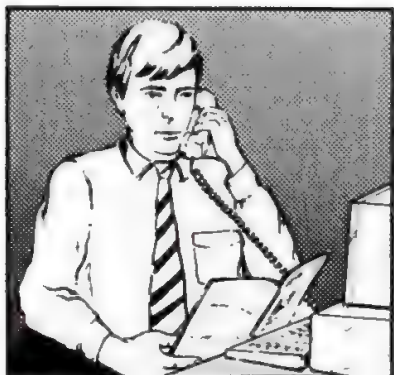
hardware and software soon. See our review of LAN management software in the November 28, 1989, *PC Magazine* ("Building Workgroup Solutions: LAN Management Systems") for more information on the right.

The clicks you hear when you are alone late at night are just the hubs reaching out to connect to your node.

NETWORK YOUR QUESTIONS

Connectivity Clinic gives you practical solutions to networking problems of all types. We'll pay \$50 or more for any tips we print, *plus an extra \$25 if you submit your letter on a disk*. If you do, please include a printed copy. We'll gladly answer your questions at no charge, but we cannot answer letters personally. Mail contributions to Connectivity Clinic, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column). You may also contact Frank J. Derfler, Jr., via MCI Mail (use Derfler's box named CONNECTIVITY CLINIC). ■

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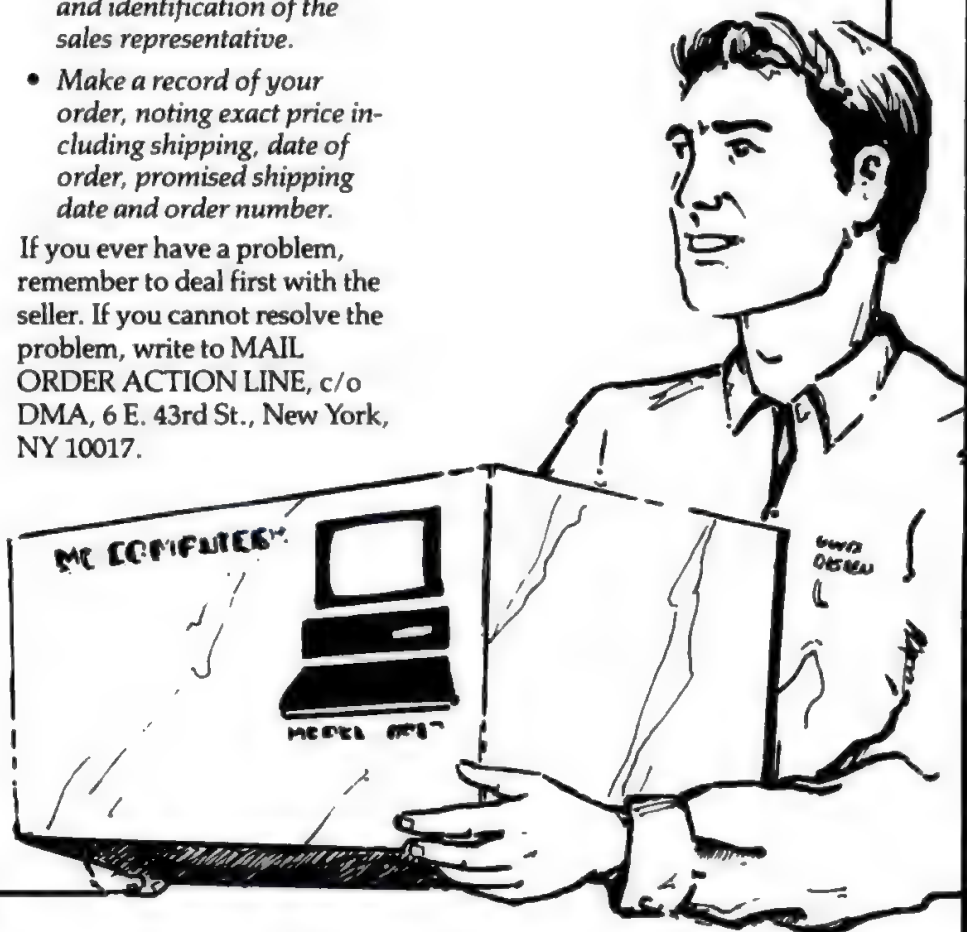
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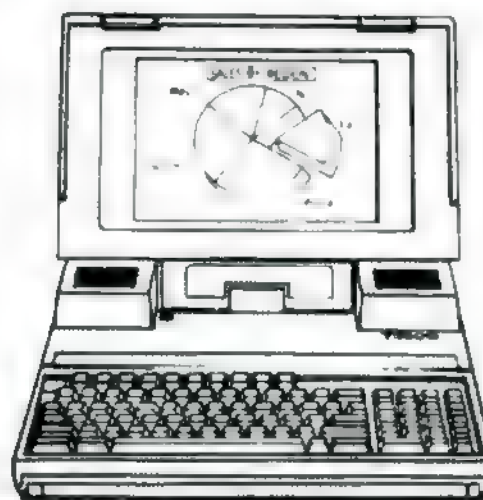
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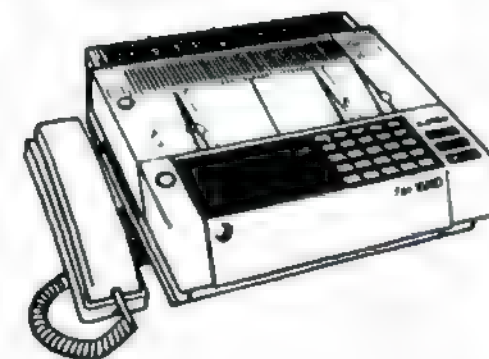
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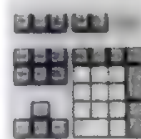
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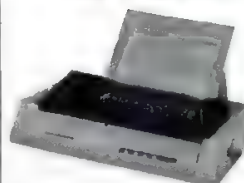
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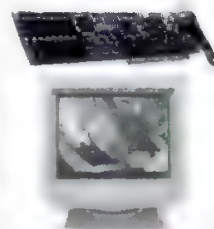
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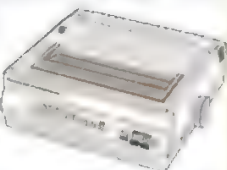
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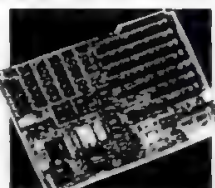
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Cocaine lies.

After nearly a decade of being America's glamour drug, researchers are starting to uncover the truth about cocaine.

It's emerging as a very dangerous substance.

No one thinks the things described here will ever happen to them. But you can never be certain. Whenever and however you use cocaine, you're playing Russian roulette.

You can't get addicted to cocaine.

Cocaine was once thought to be non-addictive, because users don't have the severe *physical* withdrawal symptoms of heroin—delirium, muscle-cramps, and convulsions.

However, cocaine is intensely addicting *psychologically*.

In animal studies, monkeys with unlimited access to cocaine self-administer until they die. One monkey pressed a bar 12,800 times to obtain a single dose of cocaine. Rhesus monkeys won't smoke tobacco or marijuana, but 100% will smoke cocaine, preferring it to sex and to food—even when starving.

Like monkey, like man.

If you take cocaine, you run a 10% chance of addiction. The

risk is higher the younger you are, and may be as high as 50% for those who smoke cocaine. (Some crack users say they felt addicted from the *first time* they smoked.)

When you're addicted, all you think about is getting and using cocaine. Family, friends, job, home, possessions, and health become unimportant.

Because cocaine is expensive, you end up doing what all addicts do. You steal, cheat, lie, deal, sell anything and everything, including yourself. All the while you risk imprisonment. Because, never forget, cocaine is illegal.

There's no way to tell who'll become addicted. But one thing is certain.

No one who is an addict, set out to become one.

C'mon, just once can't hurt you.

Cocaine hits your heart before it hits your head. Your pulse rate rockets and your blood pressure soars. Even if you're only 15, you become a prime candidate for a heart attack, a stroke, or an epileptic-type fit.

In the brain, cocaine mainly affects a primitive part where the emotions are seated. Unfortunately, this part of the brain also controls your heart and lungs.

A big hit or a cumulative overdose may interrupt the electrical signal to your heart and lungs. They simply stop.

That's how basketball player Len Bias died.

If you're unlucky the first time you do coke, your body will lack a chemical that breaks down the drug. In which case, you'll be a first time O.D. Two lines will kill you.

Sex with coke is amazing.

Cocaine's powers as a sexual stimulant have never been proved or disproved. However, the evidence seems to suggest that the drug's reputation alone serves to heighten sexual feelings. (The same thing happens in Africa, where natives swear by powdered rhinoceros horn as an aphrodisiac.)

What is certain is that continued use of cocaine leads to impotence and finally complete loss of interest in sex.

It'll make you feel great.

Cocaine makes you feel like a new man, the joke goes. The only trouble is, the first thing the new man wants is more cocaine.

It's true. After the high wears off, you may feel a little anxious, irritable, or depressed. You've got the coke blues. But fortunately, they're easy to fix, with a few more lines or another hit on the pipe.

Of course, sooner or later you have to stop. Then—for days at a time—you may feel lethargic, depressed, even suicidal.

Says Dr. Arnold Washton, one of the country's leading cocaine experts: "It's impossible for the nonuser to imagine the deep, vicious depression that a cocaine addict suffers from."

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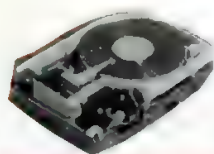
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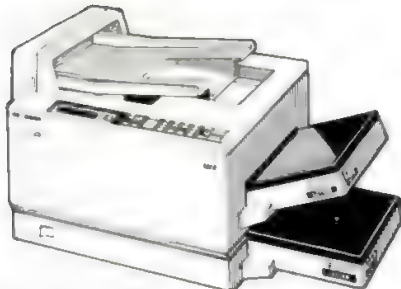
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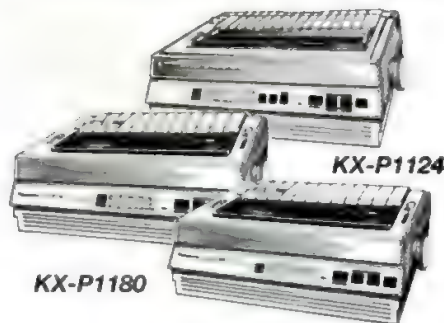
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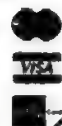


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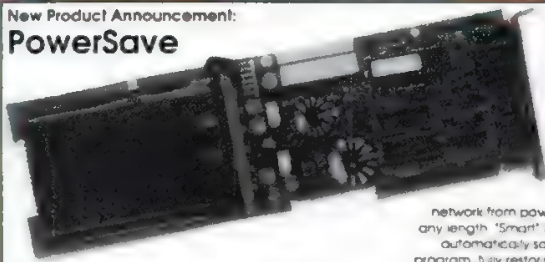
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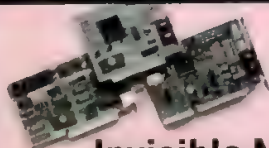
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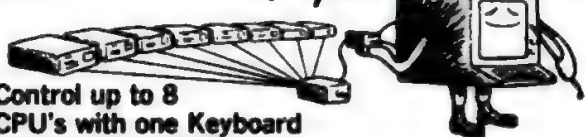
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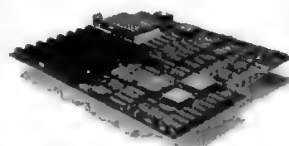
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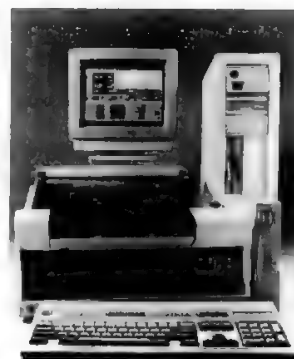
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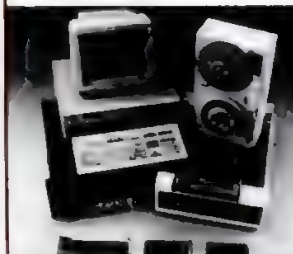
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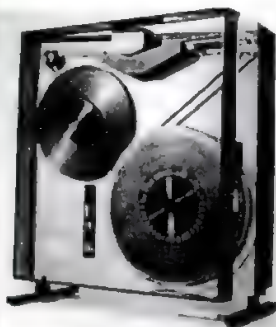
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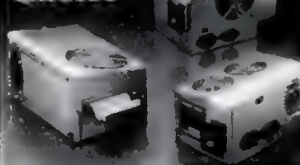
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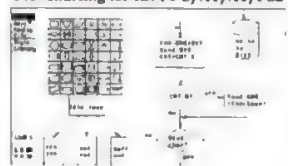
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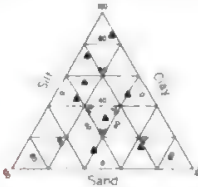
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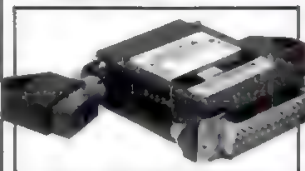
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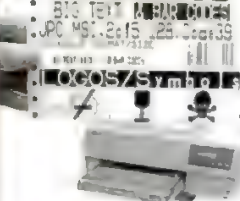
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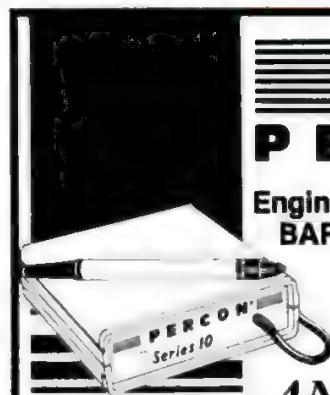
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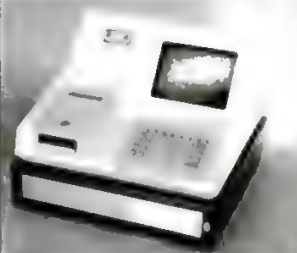
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■ PAPER-WHITE MONITORS FOR DTP AND CAD

Selecting a display for desktop publishing and computer-aided design has never been an easy task. For readers who know they want the big picture, *PC Magazine* evaluates 14 monitor and adapter combinations that produce dual-page displays with readable type. We also make sense of the rather complicated TI 34010 issue by answering the question "Does a TI 34010 processor on a board actually make a speed difference that you can notice?"

■ INTEGRATED SERVICES DIGITAL NETWORK

ISDN uses fiber optics to create a communications link that can carry voice, data, and video signals faster, more efficiently, and less expensively than the more-traditional LANs. We examine the first six ISDN-capable adapters to hit the PC market and discuss the problems ISDN faces in its quest to be tomorrow's phone system.

■ PM EXCEL HITS THE STREETS

OS/2 expert Richard Hale Shaw takes a look at Microsoft's ambitious spreadsheet for the Presentation Manager. Does it actually advance the current state-of-the-art spreadsheet, *Microsoft Excel for Windows*? Find out how *PM Excel* compares with its DOS sibling as well as with *Lotus 1-2-3*, Release 3, in both performance and capabilities. ■



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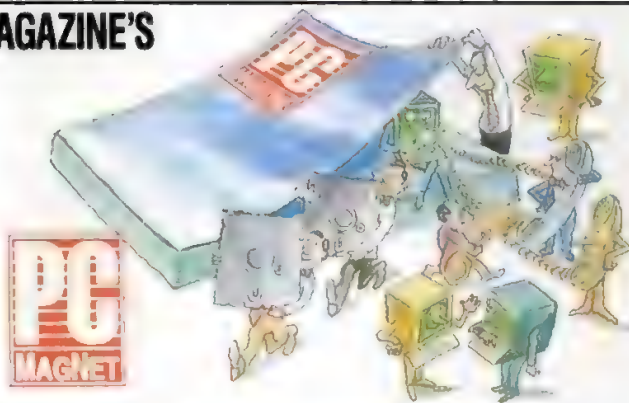
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After Hours

Products for the Leisure Side of Personal Computing

Mean Streets: Hi-Res Graphics, High Adventure

GAMES
by Don Trivette

Mean Streets, Access Software's detective thriller, is part of a new generation of computer games with improved graphics and sound. The stunning 256-color VGA screens are almost photographic in quality, although the game also supports the older EGA, CGA, and Hercules standards.

The improved sound, which requires no special hardware, comes from a system first showcased in *World Class Leader Board* (see *After Hours*, *PC Magazine*, December 12, 1989), Access Software's golf simulation. The Real Sound system supplies music, sound effects, and even voices for some of the characters.

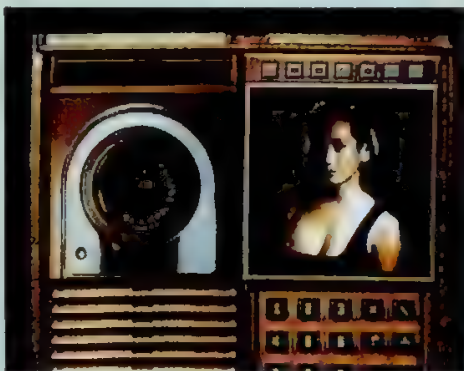
Tex Murphy—a combination Sam Spade, Perry Mason, Mattlock, and Columbo—is the star of

Mean Streets. Murphy is plenty tough, but his success ultimately depends on your problem-solving ability and determination.

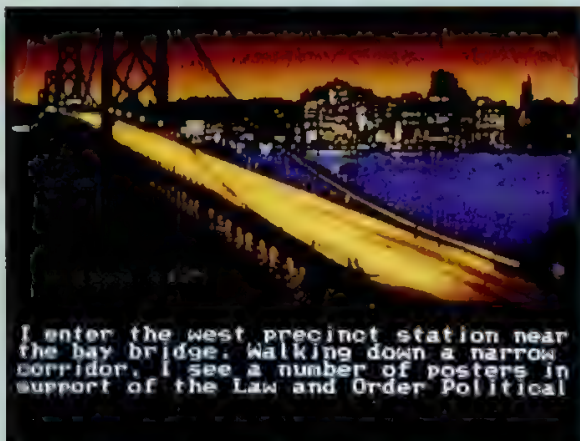
Here's the case: An attractive dame comes to your office and asks you to investigate the death of her father, Dr. Carl Linsky, a professor of neuropsychology. The police think it was suicide; Sylvia Linsky thinks oth-

erwise. She drops ten grand and a few clues on your desk. The rest is up to you and Vanessa, your faithful secretary.

Billed as an interactive detective movie, *Mean Streets* doesn't quite have the action or animation of a *King's Quest*, but you'll be so wrapped up in solving the developing mystery that you'll hardly miss trudging from screen to screen. To get from one place to another, Tex uses a 21st-century land/air vehicle called a Lotus Speeder, which has a built-in fax machine for receiving memos



The near-photographic quality of *Mean Streets'* graphics gives the game an intensely cinematic quality.



As you jet around San Francisco while playing *Mean Streets*, you'll pass the Golden Gate Bridge, among other landmarks.

from Vanessa. Aviation buffs can pilot the craft all over San Francisco and Los Angeles, where *Mean Streets* takes place. Flight-simulator burnouts like me will opt for the autopilot mode of travel.

There are more than 50 people and places to visit, including Lola Lovetoy, Big Jim Slade, Ron Meat, Alcatraz, and the coroner's office. You'll pick up information by questioning, bribing, or just plain snooping around.

In *Mean Streets*, room searches are similar to those in Lucasfilm's recent adventure games. As Tex approaches an object, a tree-like menu appears at the bottom of the screen. You then highlight items and verbs to complete an action. Instead of typing "get

GAMES

Flight Simulator gets a face-lift

SimCity, for would-be urban planners.

The latest Carmen Sandiego adventure takes you across time and space to fight crime.

the map," you highlight the word "map" and the word "get." Other action verbs include *look*, *move*, *open*, and *taste* (but don't taste the whiskey; it will make you drunk).

Mean Streets doesn't support a mouse or joystick, and because of all that's going on—sound effects, music, flight simulator, spectacular color—it's a little slow responding to the keyboard. Even on a fast AT, you may have to hold a key for a moment to get a response, but you can use the extra time to think about how to get a pass card out of the ape's cage. (Hint: a 9-foot pole is too short; look in a mountainous place for something longer.)

There's more of a mystery here than the death of a college professor, and there's also more than a few hours' worth of entertainment. It will likely take you 30 to 40 hours in some very mean streets to work your way through this game.

List Price: *Mean Streets*, \$59.95. **Requires:** 512K, graphics adapter; hard disk recommended. Copy protected through documentation. Access Software, 545 West 500 South, Bountiful, UT 84010; (800) 824-2549, (801) 298-9077.

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After Hours

Flight Simulator Upgrade Offers More Realism

GAMES
by Alfred Poser

"Microsoft Flight Simulator 4.0 cleared for takeoff." That's the air-traffic control tower at Chicago's O'Hare Airport giving you the go-ahead to fly the most popular airplane that never left the ground.

Sure, there are other programs with airplanes for your PC. There are arcade-type games that let you point your craft in any direction you want without worrying about esoteric details such as power stalls and tailspins. And there are combat simulators that may offer some aerodynamic realism but are slanted heavily toward weaponry and the tactics of war.

And then there's *Microsoft Flight Simulator*, arguably the best-selling microcomputer game of all time, with more than 1,000,000 copies sold in all versions. It may be entertainment, but it's hardly a game. The program faithfully models many complex details of small-aircraft flight. It's all in there—your plane is subject to gravity and turbulence, crosswinds and mountains, lift and stalls.

There are provisions for visual and instrument flights, including the latest in heads-up navigation displays. There are flight lessons, demos, and some challenging "follow-the-leader" scenarios where you chase a computer-generated plane. There are World War I fighter and crop-dusting games, and you can hook up two computers to the program—with both planes on both screens simultaneously—so you can fly with a friend. You can even get other scenery disks from Sub-Logic, including Europe and Japan.

But all this was true for Version 3.0. Now Microsoft has launched Version 4.0, and it soars.

It literally soars. In addition to the familiar Cessna, Learjet, and Sopwith Camel, the program-

mers have added a Schweizer 2-32 sailplane (also known as a glider). Start off a few hundred feet above a Pacific coastal ridge and you can parlay the updrafts into hours of quiet soaring. There is a second scenario where you can get your lift from freshly plowed fields, if you prefer not to go too near the water.

If you tire of the included planes, build your own with the new experimental plane-design feature. Here's fair warning, however: aeronautical engineering is trickier than it looks. I built more than one jet that looked hot on the ground but was hopelessly unstable in the air.

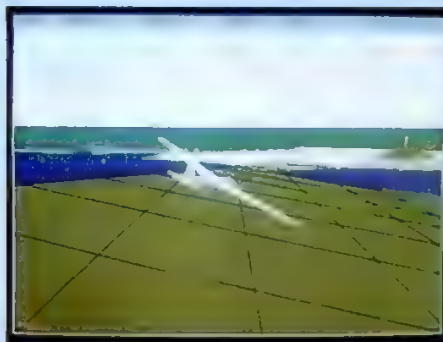
Even the air is trickier than before! In prior versions, most people would start up at Meigs Field in Chicago on a cloudless, calm day. If you wanted some clouds or a little breeze, you had to change settings on a few different menus. Now you can ask the program to start up with random weather—it can even set the season and time of day based on your computer's clock. The resulting clouds, crosswinds, and turbulence make for realistic distractions.

Be prepared for plenty of distractions with Version 4.0; some may take your breath away. For example, as you make your approach over Lake Michigan, you may see a red dot on the water. Closer inspection reveals that it is a sailboat with a brightly colored sail, heading out for a pleasure cruise. You will also

see other planes, both in the air and on the ground, which add a realistic touch. (Speaking of touching, *Flight Simulator* does



Microsoft Flight Simulator, Version 4.0, lets you custom-design a jet. Here, the PC Labs X-1 swoops over the World Trade Center.



The new version of *Flight Simulator* adds a glider to the program's complement of planes.

not yet include mid-air collisions; the other planes are window dressing and pose no real threat to your craft.) The ground scenery has more detail than ever, including animated runway lighting and more buildings. You can even converse (albeit in a very limited way) with the air-traffic controllers to obtain clearance for takeoff and landing.

All this extra detail does exact a price. While the program requirements list an IBM PC-XT as the minimum, the lag between screen updates was horrendous on an XT, and flying on an 8088 machine was nearly impossible. Imagine trying to drive a car with someone letting you see the road every 5 seconds and you'll get the idea. At the least you will want a fast 286 for this program.

In addition, the VGA images are far better than the EGA screens, so add this program to your list of compelling reasons to upgrade your graphics.

One interesting technical detail about the program: there are now separate program modules that are tuned to your processor. When you start the program, one set of choices covers your CPU, so you can select 8088, 286, or 386 as appropriate. (As with the last version of the program, you need answer these questions only once—from then on you can use a fast-start batch file that skips all the configuration questions.)

The end result is a simulation that is at the same time easier and harder to fly. The wealth of detail gives better visual clues as to where you are, and its smooth response when running on a hot 386 makes *Flight Simulator* seem like the real thing. On the other hand, the planes are more realis-

tic in their handling—the Cessna gets twitchy under certain circumstances, and it is all too easy to oversteer and get into trouble.

Flight Simulator still has no copy protection. Just put the files on your hard disk and you're ready to take off. No matter what the weather is doing outside, you can always put in some flight time on your PC. *Flight Simulator* is a great program that just got even better.

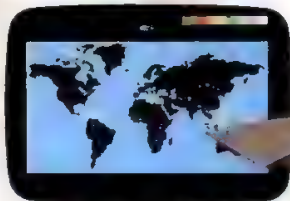
List Price: *Microsoft Flight Simulator*, Version 4.0, \$59.95.

Requires: 384K RAM (with CGA; other adapters may require more), graphics adapter, DOS 2.0 or later. Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399; (800) 426-9400.

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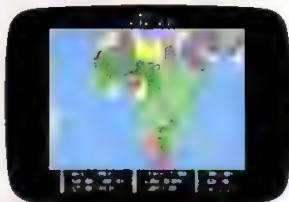
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CIRCLE 188 ON READER SERVICE CARD

After Hours

SimCity Puts You in Charge of City Hall

GAMES
by Jennifer Zaino

Have you ever wanted to pull a Clint Eastwood—you know, take some time off from your regular job and run for mayor? Well, if you think you've got everything but the campaign funds to make a real city work, put your urban management skills to the test with Maxis Software's *SimCity*.

The \$49.95 city simulator (marketed by Broderbund Software) has been a hot item in the Macintosh, Amiga, and Commodore markets for some months now. The recently released IBM version will undoubtedly have DOS junkies salivating over the chance to implement their own utopian—or less-visionary—urban plans.

In *SimCity*, you can design and build your own city—or village or town or megalopolis—from the ground up. You clear away virgin forests and shore up waterfronts with a few clicks of your mouse. Play begins in Heresville in 1900; you can regulate the passing of "years" by setting the game to run at slow, average, or fast speed.

As a beginner, you start off with \$20,000 (less if you choose a more difficult level of play). You can put that money toward developing residential areas, commercial and industrial zones, power plants, roads, and railways. All are conveniently available from an icon-based menu.

You had better plan carefully before going on a building binge—money goes pretty quickly, just as in real city budgets. A police or fire station alone will cost you \$500—and you'll have to allo-

cate funds every year for upkeep. That's in addition to the money you've got to lay out yearly for transportation maintenance!

I must confess that—once or twice—I ran completely out of funds. If this happens to you, your best bet is to raise taxes and/or decrease the transportation, fire, and police budgets. Remember, though, that significant budget decreases lead to crumbling roadways, a higher crime rate, and other problems.

Don't expect to regain fiscal health in just a couple of years, either. You may do better by just letting the game run unattended while you go off and fix dinner; this way, a good number of years will pass in which you can (hopefully) build up some cash reserves.

But letting *SimCity* run on its

population and traffic densities, pollution levels, and crime rates throughout the city. This is helpful for finding breaks in power lines; locating areas that would benefit from more housing, police stations, or roadways; and just generally planning your expansion. The Graphs window is a helpful indicator of trends in your city's life.

As your city grows in size, the SIMs will start asking for more luxurious—and expensive—items: airports, seaports, and stadiums, for example. You'll be tempted to build them even before you're asked, just for the chance to marvel at the program's glorious 16-color EGA graphics. As if the landscape—with its collection of houses, commercial centers, and industrial plants—isn't amazing enough,

after a nuclear meltdown in 2010. I think it's more fun to build from scratch; it's also less intimidating than cleaning up someone else's mess.

One of the scenarios sure to get your attention, though, is Tokyo after a monster attack. Yes, Godzilla can rear his ugly head here—or in any city you create—as long as there's enough pollution to attract him. As a matter of fact, a variety of disasters, including fires, floods, and earthquakes, can hit any city at any time. You can even activate them yourself from the Disasters menu.

If Godzilla seems a rather unrealistic element to add to the game, get braced for a few anachronisms. Like the scenario in which San Franciscan SIMs demand an airport for commerce in 1906 or the opportunity to build a nuclear power plant in 1900 Heresville. Maxis says that the game was more historically accurate in previous incarnations but was changed in response to users' requests.

My only real complaint with *SimCity* is its copy protection method. It makes use of four pages of hard-to-read, nonphotocopyable paper. It strains your eyes to peer at the small hard-copy print until you find the city name or population whose graphic code matches the three variously shaded squares on your screen.

The game's challenges—both realistic and fantastic—are sure to keep you in front of your PC for hours on

end. An educational tool as much as a recreational diversion, *SimCity* will appeal to the amateur urban planner in all of us.

List Price: *SimCity*, \$49.95.

Requires: 640K RAM for VGA or EGA graphics, 512K RAM for CGA or Hercules graphics; mouse recommended. Copy protected through documentation. Broderbund Software Inc., 17 Paul Dr., San Rafael, CA 94903-2101; (415) 492-3200.

CIRCLE 403 ON READER SERVICE CARD



SimCity puts you in the mayor's chair. You can develop your own scenario or work with one of several included models of actual cities.

own means you'll be ignoring complaints from your SIMs (simulated citizens, that is). Generally, what they like to complain about most are taxes, followed by the usual litany of grievances: high crime, unemployment, and housing costs. To quote the manual, "If they (the SIMs) get too unhappy, they move out; you collect less taxes, the city deteriorates."

SimCity's Maps window shows you land values, power grids,

wait until you see airplanes sliding skyward and ships chugging along your rivers.

You might even get to see a helicopter zipping across your screen, alerting you to heavy traffic areas via your PC speaker. The game also supports the Covox Sound Master card, available at additional cost.

SimCity comes with a set of eight prebuilt cities, including Hamburg during Allied bombing in World War II and Boston

After Hours

Carmen Sandiego Travels Across Time and Space

GAMES
by Catherine D. Miller

Designed to teach both geography and history, *Where in Time Is Carmen Sandiego?* (\$44.95) is the fifth in Broderbund Software's series of educational games based on the Carmen Sandiego character. As the detective on the case, you pursue Carmen and her V.I.L.E. (Villain's International League of Evil) gang around the globe and through the ages.

Where in Time Is Carmen Sandiego? expands significantly on previous versions of the game but retains the same simple menu-driven interface and basic program structure. Boasting 16-color EGA graphics, it comes on three

disks—a program disk and two “country” disks—rather than the single disk supplied for previous Carmen Sandiego episodes. There are more members of the gang, more places to travel, and more clues to decipher. Since the clues

building's elevator and check in at the office. The chief gives you a portable chronoskimmer, which allows you to navigate through the centuries in pursuit of Carmen's well-traveled gang. You follow criminals with names like Justin

hair color, eye color, favorite author, and favorite artist. If you don't properly identify the thief, or if you neglect to have an arrest warrant issued, another robbery goes unpunished.

The clues are seldom obvious. You need to know, for instance, that Rudyard Kipling was the first British author to win the Nobel Prize in literature. To help you decipher the clues, Broderbund includes a “Detective's Manual” and a copy of the *New American Desk Encyclopedia*.

A terrific tool for learning international history and geography, *Where in Time Is Carmen Sandiego?* also sharpens a student's powers of deductive reasoning. Carmen Sandiego's latest escapades should prove to be the most fun of all time. ■

List Price: *Where in Time Is Carmen Sandiego?*, \$44.95.

Requires: 512K RAM, graphics card, two disk drives, DOS 2.0 or later. Copy protected.

Broderbund Software, 17 Paul Dr., San Rafael, CA 94903-2101; (415) 492-3200.

CIRCLE 404 ON READER SERVICE CARD



Where in Time Is Carmen Sandiego? teaches facts of history and geography as students pursue Carmen and her gang.

lead you to time periods ranging from A.D. 400 to the 1950s, the new rendition of the program emphasizes history and culture more than previous games did.

Starting work at the Acme Detective Agency in downtown San Francisco, you enter the

Case to destinations such as Russia in the year 1000. A V.I.L.E. henchman pops up on the screen when you're on the right track.

You must identify the crook who perpetrated the crime you are investigating, a robbery. Five traits identify each criminal: sex,

MOVING?

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by
Bill Howard

Abort, Retry, Fail?

The Lighter Side of Personal Computing



Micrografx Has a Map That Explains It All

Given that Micrografx is a Texas company that sponsors a chili-cooking contest at Comdex each fall, it's not surprising to see this alternative geographical spelling of the South American country Chile (above), as printed in the November 1989 issue of *Personal Publishing*.

DAK Watch: Wow! Colors! (Grammar Checker Still Not Included)

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—Early Winter 1990 DAK Catalog

Amazing Fact

"Emerging DOS hand-helds such as the Sharp Wizard, Casio Boss and Artari Portfolio sport QWERTY keyboards, 512K of RAM and run PC-compatible software in RAM or ROM. The keyboards have a surprisingly good feel but are not typists' keyboards."

—InfoWorld, October 16, 1989

"Analysts estimate that U.S. buyers will spend more than \$1.76 billion on these battery-powered machines in 1989, and the market for IBM-compatible portables is expected to double by 1991. Traditionally, the field has been dominated by Japan's NEC and the United States' Toshiba, Zenith and Compaq. The four control about 93 percent of the portables market."

—American Way, September 15, 1989

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WITH HIS MOON IN LEO AND SCORPIO ASCENDING, BENNY SHOULD HAVE KNOWN BETTER THAN TO DIAGRAM THE NETWORK CABLING THAT DAY.



PC Magazine offers \$50 and a PC Magazine T-shirt if we use your submission in Abort, Retry, Fail? Warning: Don't write on the original if it might be reprinted; mark up a photocopy or use a Post-it. In case of duplicate entries, the neatest entry wins. Winners this issue: Robert Margolis (Chili); Jim Hanger (U.S.'s Toshiba); Laurent Hodges (Toshiba-Zenith rebate); Steve Ruud (Pallet); Jon Matzkin (DOS hand-helds).

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